THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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(J. A. Berly's).

1914 EDITION.

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CO-OPERATION.

FOR a journal having so considerable a proportion of its readers in other lands it is difficult to deliver one message on the eve of Christmas which shall be suited to the mood of all of its supporters. When these lines meet the eye of some of our Colonial friends four or five weeks will have elapsed, and the spirit of Christmas and the newness of the year will have gone. We may, however, be permitted to offer seasonable good wishes for the coming year to all, whether at home or abroad, who honour us by reading what we have to say.

Most of us are more inclined at the moment to be buying Christmas presents or entraining for the holidays than thinking deeply or writing energetically concerning any particular aspect of electrical affairs. But if there be one theme which should make its appeal to all of us in this period of peace and goodwill, it is that of co-operation for the good of the electrical profession and industry. We have repeatedly witnessed the success of organised unity within one particular section for the purpose of negotiation or contention with some other section, and we are hoping for excellent results to follow such movements as that which has been started by the Municipal Electrical Association, with a view to developing the electric vehicle industry in this country. Better far, however, than sectional movements would be one general advance movement in which everybody electrical would aid the progress of everything electrical.

We are not inclined to the view that trans-Atlantic methods, pure and unadulterated, can be applied with any great measure of success here, but the spirit and motive which have led to the adoption of those methods in connection with electricity supply are a subject for admiration and emulation. The pages of our American contemporaries are occupied pretty well every week with information concerning the progress that is being made in the States with the work of the Society for Electrical Development. This is a co-operative movement to which we have made reference on several occasions. It has for its object the promotion of electrical popularity, and is an organisation which has been described as a clearing house for original, effective ideas in selling electrical goods and extending markets. Apparently it has not been formed to be a profit-earning venture, but according to a description in an American exchange, members will stand to profit individually through the co-operation for business developments which it makes possible. The plan on which it has been promoted is said to be more comprehensive than that of any other similar movement in the electrical trade, and the opinion has been freely expressed that its influence will be felt later in other industries as its work becomes more firmly established.

The work which the society intends to carry out lies in such fields as the strenuous advocacy of the use of electrical energy for lighting, heating and power; of electric railways; of electrical appliances for agricultural purposes; of electric

cooking and the many different domestic uses that can be made of electrical energy. The society embraces three departments, although more may be added later. These are the advertising department, the publicity and editorial department, and the field department. The advertising department will be concerned with the placing of general advertising with the Press, whilst the publicity department will prepare the matter for publication, and collect and disseminate news which will assist in pushing the sale of electricity in various directions. The field department will have a number of duties, amongst which may be mentioned co-operating with architects, builders, &c., upon matters such as wiring and other specifications; conferring with Boards of Trade, Chambers of Commerce, and public authorities, to bring about better understandings upon disputed topics, and advising with such bodies as fire insurance companies as to commercial requirements, from the standpoint of the industry and of the consumer.

It is pointed out that later other important subjects may be brought into the province of the field department, such as advising central stations as to rates for energy, so as to increase profitable business, and especially day loads; the introduction of elementary electrical courses into public schools, and the enactment of equitable public utility laws and regulations.

It is interesting to note that when the Society recently offered a prize for a Slogan there were five winners who all suggested the expression, "Do it electrically." This may be taken as an indication of the widespread recognition among electrical men of the need for educating the public concerning the abilities of electricity to serve advantageously in every department of daily life. Further, the fact that as many as 2,675 replies were received competing for the Society's design prize, may be cited as an indication of the haedway that the movement has already made in American electrical circles.

In view of the larger place that the cinematograph is today taking in the life of the people, the Society is availing itself of this means of getting its teaching home. Arrangements have been made with a moving-picture concern for one 1,000-ft. film, telling the story of the uses of electricity in the factory and the home, which can be used by central-station members in the popular picture theatres, and which is rented from the moving-picture concern at the rate of five dollars per day, with a minimum of two days' use.

The opinion has been expressed, an opinion with which we are disposed to agree, bearing in mind the conditions which obtain in the United States, that the mere existence of the society is practically a guarantee of its success, since it implies a universal recognition on the part of the electrical interests of a fundamental truth. It will aim to clear away the obstacles which stand in the way of further expansion of the whole electrical business, whether these are set up by the ignorance of the public or by internal dissensions, and manufacturer, central-station engineer, and contractor alike stand to gain by its efforts.

The German Lighting Appliances Tax.

As is already known, the German export trade in incandescent mantles, glow lamps and arc lamp carbons to Canada, and of mantles and glow lamps to the United States, has been greatly prejudiced by the inclusion by these countries of the amount of the German tax in calculating the values for the assessment of the import duties. The result is that the German manufactures in question are subject to a considerably higher charge than similar exports from other countries to Canada and the United States. In this connection, an association for the protection of the common economic interests of the German electrical trades points out that the possibility of ousting German industry from the United States, by embodying the tax in the computation of the duty, has induced the Government of the latter country, under the new tariff, to levy an *ad valorem* duty on carbons for so-called flame arc lamps, whereas formerly these carbons were subject to a duty according to their length. As a consequence, it is considered that this particular business will be entirely lost in a short time—a fact which constitutes a heavy blow, as 15·4 per cent. of the total exports of carbons has hitherto been forwarded to the United States. Any representations to the Government of the United States, judging from previous experience, would appear to have no prospect of bringing about an alteration in the present state of affairs, and the association suggests that the only remedy for the destructive results of the lighting appliances impost lies in the abolition of the tax.

Municipal Officers as Arbitrators.

It is interesting to notice that the *Justice of the Peace*, a legal journal which gets into the office of nearly every local authority in the kingdom, recently took up the question of municipal officers acting as arbitrators—a question which has frequently come before the Courts during the last few years. The attitude of members of the local authority on this matter can be easily understood. Arbitration is preferred to litigation, because it is less notorious; arbitration conducted before one who happens to be the paid official of the county or town council concerned is very likely to have a satisfactory termination. The "County Councillor's Legal Guide," if we may so describe our esteemed contemporary, draws certain very important conclusions from the various cases which have been decided on the subject.

While the rule that a judge should not hear cases in which he might be *suspected* of having a bias in favour of one party does not apply to an arbitrator named in a contract, and chosen by the parties, principles of law are very elastic, more so than the written Act, and the arbitrator, notwithstanding the formal exclusion of the above-mentioned rule, soon finds himself surrounded with every part and application of the old rule which has not been expressly rendered nugatory by the contract. His judicial discretion is rigid, and is rigidly construed, and confers very little freedom of will.

Thus, although a mere suspicion that he may be biased will not impeach his appointment, a probability that he will, in fact, be unduly influenced, disqualifies him from acting. Again, although he may adjudicate upon his own work and skill performed professionally under the contract, he may not adjudicate upon any allegation made by the other contracting party that his own conduct has been wrong according to the contract, or that he has acted tortiously in regard to the other party. There is a special relationship between an arbitrator and a contractor "from the point of view of the contract," which may raise substantive questions of delay, indecision, &c., in carrying out the engineer's professional duties under the contract. Another rule is that if, acting for a local authority, an arbitrator is charged with obstructing a person who is under a contract with the authority, the charge may be carried by the contractor into court. A third distinction may be noticed. It was decided in a case heard in 1902 that the arbitrator may adjudicate upon his employer's interests. In that case Lord Justice Mathew said that the arbitrator, as architect, surveyor, or engineer, is bound to do his best for his employer and look sharply after the other contracting party, and as arbitrator he is entitled to determine differences between the two, which the contract evidently anticipates. On the other hand, he must not be influenced by his employer personally, or allow his judgment to be overborne by what the employer demands. Neither will an action on the contract be stayed if the arbitrator has proceeded on the assumption that he was bound to take his orders from his employer.

THE RUSHMORE ELECTRIC ENGINE STARTER.

Although it must be admitted that we have somewhat lagged behind America, indications are not wanting that the serious attention of British motor manufacturers and motorists has at last been drawn to the advantage of engine-starting arrangements, whereby the old-fashioned starting handle of petrol cars and its attendant inconveniences are rendered things of the past. Thus at the recent Motor Show at Olympia it was found that such devices had been adopted on quite a number of cars, while among the exhibits in the Accessory Section there were a number of engine starters on view, some of a mechanical and some of an electrical character. Prominent among the latter was the new Rushmore electric starter, which is being introduced into this country by Rushmore Lamps, Ltd., of 46, Brewer Street, Piccadilly Circus, London, W.

There is some division of opinion amongst experts as to the advisability or otherwise of combining the functions of a car-lighting dynamo with that of an engine starter—such machines requiring to be constructed as combination generators and motors—but Mr. S. W. Rushmore, who is responsible for the new starter, and who has had over 25 years' experience in the design and manufacture of electric motors and dynamos, emphatically holds the view that the functions of generating current for the lamps and storage battery, and of starting the engine can never be satisfactorily performed by a single machine. It is, therefore, almost needless to say that the Rushmore starter is a separate unit, specially designed for the purpose for which it is intended, and one of its great features, apart from

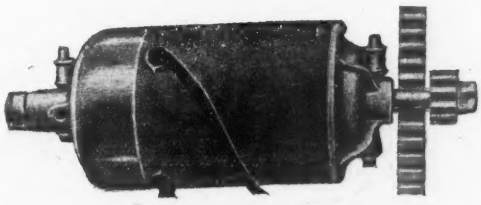


Fig. 1.—Rushmore Starting Motor

its lightness and compactness, is its simplicity and freedom from auxiliary mechanism, such as reducing gears, clutches and ratchets.

The starter is arranged to act directly on the engine, through the medium of a pinion and a toothed ring formed on the periphery of the fly-wheel. The means adopted for the throwing in and out of the gear are extremely interesting, the operation depending on the application of a well-known electro-magnetic principle, namely, that an armature will

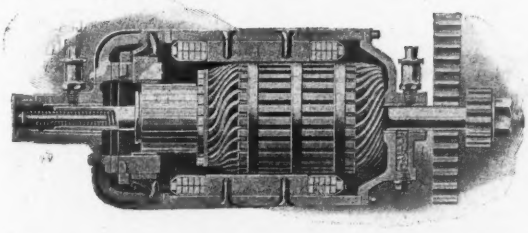


Fig. 2.—Sectional View, Rushmore Starting Motor.

always adjust itself symmetrically in the magnetic field created by the field magnets—the armature, in other words, being pulled into a central position. Thus, from the accompanying sectional view, it will be noted that the spindle on which the armature and driving pinion are mounted is made somewhat longer than usual; normally, the armature is held out of line with the pole pieces by means of a compression spring located within the commutator end of the spindle, the pinion, in this position, being out of mesh with the fly-wheel gear. To start the engine, a foot-button switch is pressed down, this allowing current from the battery to pass to the pole pieces; becoming energised, the latter exert a powerful endwise pull on the armature, which, overcoming the power of the spring, pulls the pinion into gear with the fly-wheel, and by rotating the latter, starts up the engine. The armature is made a little longer than the pole pieces, so that even when the former is rotating, a sufficient pull is exerted on it, to overcome the spring action.

To enable the pinion to be brought into mesh quietly and without danger of damaging the teeth, the operating switch is provided with two active contacts, the first one of which causes the contact arm to close the circuit between the battery and the motor, permitting a comparatively heavy current to flow through the field windings to pull the armature into position, the latter, meanwhile, due to the provision of a shunt circuit, only rotating slowly, so that the gear teeth are drawn together by a combined pulling and twisting movement. The method of operating the switch is easily acquired, it being only necessary to give it two sharp jerks by the foot, with a quarter of a second's pause between, to give the armature an opportunity of making the 1¼ in. end movement required to bring the gears together, before the motor exerts its full power.

Presuming the engine to be started, the next question to be considered is that of the disengagement of the starter, and it is here that Mr. Rushmore has brought his long experience into service. At first sight, it would appear that the disengagement is effected merely by the end movement of the armature. Apart from the fact that such an arrangement is, in itself, not new, it would obviously be impossible to rely on the switch movement to cause the disengagement of the gears after the engine has started, for the acceleration of the fly-wheel is generally so rapid that the motor would probably be destroyed by centrifugal action, while the noise would be altogether too great. Closer inspection reveals the fact that the operation depends not so much on this simple mechanical arrangement as in the electrical principles involved. The natural tendency of the starter, like all series motors, is to "race" when the load is removed. At the instant of first explosion, the motor, therefore, accelerates as rapidly as the engine; the resulting increase in the counter electromotive force that takes place instantly reduces the starting current to a comparatively small amount, so that the field poles can no longer hold the armature against the pressure of the spring, the pinion thus slipping quietly out of engagement before any increase in the speed of the fly-wheel can be noted. The motor then continues to run in the disengaged position until the switch button is released, this operation being performed by the driver as soon as the car is under way. The current consumption under this condition is too small to enable the pole pieces to exert a pull greater than the strength of the spring, so that the latter maintains the pinion out of mesh when the motor is running idle, but to prevent any risk of it being brought back into contact with the rapidly-moving fly-wheel, the switch is so arranged that on its return movement, the connection to the battery is broken before the circuit across the armature is again restored.

The starter is essentially a series-wound motor arranged to deliver for brief intervals only the maximum amount of power with maximum efficiency, it being consequently in no way hampered by temperature-rise considerations. It is of the ironclad type, with four poles and four brushes. Furthermore, as the motor only runs when the engine is being started, the wear on the commutator and brushes is reduced to a minimum, the latter being constantly and automatically lubricated.

Two sizes of the starter are being made: the standard one is the Model B, which weighs 47 lb. without the switch, and is able to drive a 60-h.p. six-cylinder engine at 80 r.p.m., using less than 600 watts, while it will turn a 4-in. bore engine sufficiently fast to start it directly on the

magneto. The Model A starter, which weighs 62 lb., is intended for engines which, owing to their size or high compression, require a more powerful motor. Owing to the high efficiency of the device—the motor being claimed to deliver to the fly-wheel, in actual horse-power, 75 per cent. of the energy received from the battery—and partly to the absence of gears, it is stated that a battery from 20 to 30 per cent. smaller than is customary can be used. For the starting of average touring car engines, a 6-volt battery of 120-180 ampere-hour capacity is recommended, larger or smaller sets being, of course, employed with higher or lower powered motors.

We understand that although the Rushmore starter has only recently been introduced on the market in this country, a number of British motor-car manufacturers are already experimenting with the device with the view of its adoption, and that it will form a standard fitting on the 1914 Lancia cars. Before arriving at this decision, a series of exhaustive trials were carried out at the Lancia factory in Turin on a 30-60-H.P. engine ; notwithstanding the high compression of the same, the starter, in over 1,000 tests, never failed to start the engine, running it at 96 R.P.M., and consuming only 110 amperes from the 5·8-volt battery.

REVIEWS.

Electric Lighting. By W. S. Franklin. 1912. London : Macmillan & Co., Ltd. Price 10s. 6d. net.

Usually the title of a book informs one of the subject matter which is to be found within its pages, but in the case of the work now before us it does not by any means indicate the ground covered. Certainly four chapters of the nine, which this book contains, relate to illumination, but the remainder treat of operating costs, electrical distributions, batteries, and telegraphs and telephones.

It is very difficult to understand the class of reader for which the book is intended, in spite of the information that it is a "Text-Book for Technical Schools and Colleges," but we believe that it could be adopted with success into the curriculum on this side of this Atlantic ; a revision of its contents for English readers would no doubt be of service, and it would also be necessary to supplement it with other works.

The first chapter deals with costs and selling price and makes more interesting and concise reading than some recent works published in this country. A few paragraphs only are devoted to meters in this chapter, so little ground being covered, that anyone depending on this work for general electrical knowledge can have but elementary ideas of the most important instruments now in use.

The various systems of electrical distribution are discussed in a brief manner, which should be of great use to anyone learning the subject. A somewhat peculiar paragraph appears under the heading of Mechanical Stresses in Aerial Wires and their Supports, reading :—"A coating of ice one-eighth of an inch thick is seldom exceeded, and it is cheaper to repair the line after an excessively severe sleet storm, than it is to make it strong enough to sustain one-eighth of an inch of ice on the wires" ; fortunately, in this country such storms are of infrequent occurrence, but it is doubtful whether this argument would be countenanced, since the question of reliability is usually of far greater importance to us, and such delays would speedily cause a company to seek the Bankruptcy Court. The calculations contained in this chapter are indeed useful, and are quite handy to have by one, but again one's attention is drawn to the country of origin of the work. Alternating-current lines are concisely but well treated of in the next chapter.

Not until we reach Chapter IV do we come upon the real subject of the title, and here under the heading of photometry and illumination the author deals with the fundamental ideas upon which modern illumination is based. The units are very fully discussed, and the definition of the lumen, usually the greatest stumbling block, is very clear, especially when the diagram relating thereto is utilised. The law of inverse squares is well explained, and one or two problems dependent upon it will be found to be most instructive. We cannot do other than congratulate the author upon this section of his work. Reflection and absorption are fully discussed in connection with the subject of lenses. A brief description of the Bunsen photometer leads one on to the distribution of light around a lamp and calculations usually associated with photometry. By dealing with the subject in this way, the author enables one the better to understand the matter following, which discusses complete photometers of the modern type.

The next chapter is devoted to the description and consideration of the various types of electric lamps, their shortcomings and adaptabilities. The variation of candle-power of the numerous filament lamps is diagrammatically illustrated, as well as their useful life, &c. The polar curves are of great interest, and since comparative costs are given very fully the commercial side of the question is not lost sight of. The fact that the costs given are American is a drawback, since the corresponding figures in England will not be identical, such items as labour charges being totally different. The modern reflector problem is carefully explained, and the possibilities of the numerous materials which may be utilised in this direction are well set out.

In the following chapter the considerations for interior illumination are dealt with, and we can recommend the matter contained therein, since there are few books which treat of this portion of the subject in such a useful way. The intensities of illumination suggested for various classes of service are exhaustive, and are not on the high side, as is usually found with such tables as emanate from the States. The table of lumens, however, is distinctly American, for the lamps are obviously rated at a higher "efficiency" than is attained here.

Street lighting is an important subject, and a whole chapter is allowed for it, but it is very doubtful whether much of this is of value in England, since "series" lighting with glow lamps is nowhere in vogue to any large extent save abroad.

Chapter VIII treats of electrolysis and batteries, so that the author has now left the subject of his title, but the matters discussed are dealt with in a very able manner, methodically leading on to storage cells and the booster. It has been our experience that the average electrical student has very hazy ideas on these subjects, and we therefore recommend the perusal of these pages to all those whose intention it is to understand the applications of electricity in a practical and everyday manner. Similar remarks may be made regarding the miscellaneous applications which form the subject of the next chapter, for generally the telegraph and telephone are considered to be outside the sphere of the electrical engineer, ; however, we believe that every student should have at least some acquaintance with modern methods, which enable many messages to be transmitted over the same wire. Mr. Franklin certainly writes so that all may understand ; even railway block signalling and track circuiting are introduced, and in view of the publicity lately given to such subjects they should prove of interest to all engineers.

The appendix on dielectric stresses should enable one to perceive more clearly the why and wherefore of many insulating devices which may not be apparent at first sight.

The volume concludes with numerous problems which the keen student will endeavour to master in order to satisfy himself that he has fully understood the author's meaning ; these problems are far from being entirely theoretical, in fact, this work is to be commended before many of the so-called text-books on account of the practical way in which it is generally written. It is quite refreshing to pick up such a book, and our only regret is that only the author did not cover more ground and give the work a more befitting title.

The Working of Steam Boilers. By E. S. Hiller. Fifth Edition. Manchester: Taylor, Garnett, Evans & Co., Ltd. Price 1s. 6d. net.

This is the publication of the National Boiler Insurance Co., of Manchester, being a series of notes and instructions on steam boilers, their appurtenances, fittings and working for the use of owners, engineers and firemen. These notes are good and valuable, both from an immediate money point of view and from considerations of safety. Thus, one note says that coal prices do not by any means always agree with calorific values. A small coal may have a high calorific value, and yet be useless if it cannot be burned sufficiently fast to raise the amount of steam wanted. This fact may be used with advantage by the man who has sufficient grate surface to enable him to surmount the difficulty of slow combustion, or who has a tall roomy chimney, or a fan or other aid. Again, a high calorific value may not be a true criterion of value, for some coals are productive of difficult clinker, and so on.

The advice to close the pores of flue brickwork by some paint is pleasing to us, because when put forward by the reviewer many years ago such advice was described in Lancashire by language not fit for publication. All the same the advice was good, and it is still worth printers' ink, for not everyone follows it who should do, and might do with advantage. Cautions are given as to the treatment of water and the use of chemicals. Notably alumino-ferric is apt to produce corrosion, and so is ammonia. Boiler compounds, too, are often dangerous. There are numerous illustrations of exploded boilers, sufficiently horrible, one would think, to frighten any steam user from playing the fool with his boilers by neglecting the insurance company's warnings in the way so many do.

When an internally-fired boiler is short of water, it is difficult to judge what is best to be done. In any case, fling the fire-doors wide. Do not draw the fires. If the crowns are not yet very hot, it may, perhaps, be still possible to throw wet coal or ashes upon the fires, but this is risky to the man who does it, and shows unselfish courage. It is safer to keep away from the boiler front and to turn on the feed. It is advised to close the dampers. May it not be even better to open them wide, if the furnace doors are also wide open? But with mechanical stokers there can be usually no wide opening of doors, for there are no such large fire-doors. It may be possible to turn on a heavy feed of fuel and close the dampers. This might produce great volumes of smoke, besides cooling the fires by the latency of heat consequent on heavy gas production. It has been said that a fireman requires muscle and no brains, but we venture to say that a fireman with an elementary knowledge of chemistry and thermophysics would, by pondering over these subjects, acquire so much power of judgment when in a tight corner, that he would be able to strike a tolerably correct course of action. Uneducated men are made afraid of the sciences because they are not presented to them properly. Yet what is more simple than elementary chemistry? A simple statement of the atomic theory, for example; an explanation of the phenomenon of heat by means of the thermometer and the gradual reduction of ice to steam with heat supplied continuously, and the thermometer at one time steadily rising, at another period standing still, while the solid water is passing into the liquid form and later into vapour.

Let the man grasp the joint idea of the concurrent change of state and stationary mercury, and then teach him that these same changes and heat variations pertain to other bodies—metals, coal, &c.—and his powers of observation will have been raised and refined fifty-fold. And who will contend that such an elementary knowledge will not help a man to fire smokelessly, when he understands the serious chilling of a fire that latency of heat, due to the distillation of green fuel, brings about? We think a little of this teaching might go into the next edition of this book. And is the author certain that when he sends it forth it always finds its way into the boiler house, where it should be?

Swiss Exports to Spain.—According to a return lately issued, electric machinery to the extent of £56,388 was last year imported into Spain from Switzerland.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Concerning a Review.

I have bought a small book, entitled "Switchgear and the Control of Electric Light and Power Circuits," by A. G. Collis, which has been favourably reviewed in your columns. It seems incredible that any reviewer could recommend it. There are 44 diagrams, in 72 pages, many being practically full-page ones, and some of them are hopelessly inaccurate and misleading, although obviously intended to be self-explanatory.

The book is only a small one, price one shilling, but frequently one's decision to buy more expensive books is clinched by the perusal of a review; I take it that reviews are published to this end. This being so, it is surely not too much for book buyers to expect reviews to be reasonably accurate.

In the present case, if the reviewer read the book without reference to the figures, he certainly could not understand it, and if he did refer to the figures, and had a copy of the book similar to mine, it is equally certain that he did not follow it. In fact, the view most flattering to the reviewer is that he did not read the book at all, but took its utility and accuracy for granted.

It is to be hoped that the diagrams are not simply taken from the author's larger book referred to in the preface; if they are, I pity the purchasers of the latter.

R. Rankin.

Ilford, *December 18th*, 1913.

Reviewers as a class are fairly well acquainted with objections from authors whose works they have been compelled to criticise, but an objection from a person who has bought a book on the strength of a review is somewhat of a novelty.

The objections in this case appear to be (1) that the book consists of *only* 72 pages and 44 diagrams, many being practically full-page ones; and (2) that *some* of the diagrams are hopelessly inaccurate and misleading.

The reviewer's answer to (1) is:—What do some people expect for a shilling? and to (2) that while the reviewer makes no claim of being infallible, or even of being a professional proof reader, he certainly does claim that whatever errors do exist in the book are few in number and easily detected by a mere tyro. Presumably the book is not intended for use in a kindergarten school. Further, it was pointed out that the meanings of various symbols were not explained.

The gratuitous insult contained in the last paragraph but one of the above letter is not considered by the reviewer to be worth criticism.

By the way, is Mr. Rankin sure that he threw his shilling away (in his own opinion) solely on the strength of the review in the Electrical Review, and was not influenced by a very favourable review of the book—by another reviewer, of course—in a contemporary?

The Reviewer.

Heating Elements.

We note in your current issue a description and illustration of a heating element which Messrs. Bastian Electric Heating Syndicate, Ltd., are introducing as a novelty, under the title of "Rodolite." This type of heating element may be new to the firm referred to, but we may be permitted to point out, as a matter of fact and in the interests of the electrical heating industry, that this particular device is a somewhat old pattern.

We have been using these elements for some years, and they are referred to in the Electrical Review of October 6th, 1911, page 543, also in the *Journal* of the Iron and Steel Institute for June, 1908, and other technical papers.

Standard Electrical Heating Co.

Newcastle-on-Tyne,
December 19th, 1913.

Profit-Sharing and Co-Partnership.

I see you have done me the honour to comment upon some remarks of mine at the recent meetings of the Labour Co-partnership Association at Leeds.

I agree it is highly desirable to have working definitions. What are profit-sharing and labour co-partnership?

Profit-sharing is the giving by the employer to his employés, in addition to the standard wages of the trade, of a proportion of any profit he makes beyond bare interest on capital. Under labour co-partnership, which is a natural outgrowth of profit-sharing, the profits given to workers are usually given in scrip representing shares (in the business employing him) entitled to future dividends in cash.

An essential feature, either in simple profit-sharing or in labour co-partnership, is that the profit given to (not bought by) a worker is given to him as a worker, not as a shareholder. Under the Furness scheme the worker got facilities for buying shares bit by bit out of his wages. Under a labour co-partnership scheme the worker gets given shares, not facilities for buying them. The difference need not be laboured.

"Co-partnery" is an ugly synonym for "co-partnership."

Theo. C. Taylor.

Batley, *December 18th*, 1913.

Co-operative Control of Electric Supply Undertakings.

There is no doubt that the number of men who firmly believe in the superiority of this method is rapidly increasing, not only in this country, but abroad as well.

It appears to me to be the only common-sense method. It adequately protects the public and the consumer, and gives the advantage of the freedom of private company management. I am quite as much opposed to uncontrolled company management of public utilities as to municipal or State management.

Mr. Chattock's article on this subject contains a dangerous heresy in the following words :—

> The arrangement certainly eliminates some of the disadvantages both of company-controlled and municipal undertakings, but it retains the chief and serious disadvantage of exploiting the supply of electrical energy, with the sole ultimate object of earning profits, whether small or large, for the benefit of the shareholders.
>
> This is laudable enough in a concern that is being run in the interests of a few individuals, but, where the well-being of the whole community depends so vitally upon a cheap supply, and upon husbanding the resources of the fuel supply, the result should never, under any conditions, be subject to such a powerful restriction.

Surely Mr. Chattock is not becoming an avowed Socialist, for think what his sentiments mean!

If he really means what he says, he believes in the public control and management of all commodities and services essential and semi-essential to the community. Electricity supply is a semi-essential service—exceedingly useful but not indispensable as compared with food supplies—and if the electric service is to be municipal or State managed in order to avoid its being exploited on behalf of shareholders, we must agree to the principle of municipal and State farms, flour mills, bakeries, milk farms, dairies, dispensaries, doctors, and so on, *ad nauseam*; in fact, we are to accept *in toto* the entire Communist programme.

I really cannot imagine that Mr. Chattock means this, but it absolutely follows upon his statement.

There are most serious evils inseparable from the Nationalisation and Municipalisation of anything. I will put them as briefly as possible; I *must* put them, because they cut at the very roots of our national commercial prosperity :—

> (*a*) Extinction of individual initiative, naturally followed by a
> (*b*) Decline in improvements and progress, resulting in
> (*c*) Other countries which do not suffer from State and municipal interference in business getting ahead of us.
> (*d*) Decline in personal and financial responsibility of directors, resulting in inevitable loss of efficiency. (What personal responsibility, for instance, has our Postmaster-General?—Merely a political responsibility to the particular political party in power for the time being, who will generally sell their very souls for votes.)
> (*e*) The object is the altruistic carrying-on of business in the sole interests of the community, a perfectly hopeless endeavour at perfection, because it is ingrained in the vast majority of men to work for reward in some shape or form.
>
> It is unnatural to 95 per cent. of human beings to work at the same efficiency regardless of the remuneration of their services.
>
> This is one of the idealistic rocks upon which unpractical Socialism comes to grief.

I believe these to be the principal objections; there are innumerable minor ones.

Then Mr. Chattock goes on :—

> The only alternative that I can see, therefore, is nationalisation of the supply, *i.e.*, control of the whole of the supply by a Government department, in a similar way to the control of the Post Office and of the telephone service. I am aware that the latter is not at the moment a very happy example, but it is only a question of proper organisation to put this service on a satisfactory basis. There is just as much, if not more, justification for this, as there is in the proposal for the State to take over the railways.

The premises are faulty: there is no justification for the nationalisation of railways. The only point in its favour is the importance of railways in time of war; then I agree that for the time being the State must control them, and it should always be in a position to demand and have carried out at all times arrangements providing for that contingency.

Further, the present inefficiency of the telephone service is not a question of proper organisation; the necessary organisation cannot come from national management; proper organisation is hopeless until the business is managed by people who are placed in such a position that the greater the facilities they give the public in the way of lower cost of the service and excellence of service, the more money they are to be allowed to put into their own pockets as remuneration.

I believe strongly in altruism in business, but it is not coming of its own accord so long as human nature is what it is; but it can be induced by a prospect of reward simply because honesty, if I may be excused the truism, is the best "policy."

To my mind, in connection with true co-operative control of electric supply undertakings, methods could quite easily be devised by which the public interests would be fully safeguarded and the business not unduly hampered.

A. Hugh Seabrook,
General Manager.

St. Marylebone Electric Supply,
December 20th, 1913.

ELECTRIC UNDERTAKINGS AND WATER-POWER IN CATALONIA.

It is generally accepted that the industrial position of Catalonia and district is destined to undergo very rapid development in the near future, and that this development will largely depend on the rational and economic use of electric power. The province of Barcelona, especially, which is the centre of the important Spanish textile industry, is destined to gain enormously by the use of the vast potential resources for the development of electric energy and the consequent cheapening of power.

In this connection a recent Austrian Consular report states that this impetus to the industrial life of Catalonia is primarily due to the enterprise of Dr. Pearson, who has also operated in a similar way in Brazil and Mexico by the establishment of the Rio de Janeiro Tramway Light and Power Co. and the Mexican Light and Power Company. The exploitation of Spanish resources by Dr. Pearson began with the formation in Toronto, on September 12th, 1911, of the Barcelona Traction, Light and Power Co., Ltd., with a capital of 25,000,000 dollars, chiefly subscribed by English, Belgian, French and Spanish interests. One of the first steps taken by the company in Barcelona was the purchase of the electrical works of the Sociedad Barcelonesa di Electricidad, as well as the taking over of the electric railway Barcelona-Sarria. A new issue of shares following these acquisitions, brought up the capital to £7,000,000, and the original title of the company was changed into the Riegos y Fuerza del Ebro S.A. (Ebro Irrigation and Power Co. Ltd.). The said company, which is known in Spain as La Canadiense, has more and more extended its operations as time has passed. In the first place Dr. Pearson has succeeded in overcoming the keen competition of the Sociedad Electrica Energia de Catazafia. This company worked chiefly with French capital, and had a number of valuable falls in the Pyrenees. Dr. Pearson acquired 49 per cent of the shares with the option of acquiring the remainder in succeeding years. Further, an arrangement

was made for the establishment of spheres of influence for the two companies, which would ensure a lack of competition. In addition the Canadian company has bought up the Sociedad Anonima El Tibidabo, and has secured a considerable influence in the electric tramways of Barcelona and the district. Leaving out of account certain suburban lines, there are two tramway companies; the company Los Tranvias de Barcelona (formerly English, now Belgian) and the Compania General de Tranvias (originally German, founded by the A.E.G.). Dr. Pearson has now come to an arrangement with these companies whereby a dividend increasing from 11 to 15 per cent. will be guaranteed to the shareholders. This guarantee will have effect from 1913 to 1945, the period which the chief concessions have to run. It remains to be seen whether Dr. Pearson will succeed in developing his undertakings on a profitable basis. On this point there is much doubt in business circles, as there is distinct evidence that he will have to contend with financial difficulties.

Of the most important works of the Riegos y Fuerza del Ebro (which has concessions for the appropriation of water power in the Noguera-Pallaresa, Segre, and Ebro) the following are in contemplation:—

The installation of an electric station in Aytona, near Seros, on the river Segre, with four generators which will make possible a development of 56,000 H.P. This installation is expected to be ready at the end of the year.

The main station of "Los Terradets," with two sub-stations on the Noguera-Pallaresa river, will provide 83,000 H.P., and should be finished by the end of 1914.

In Pobla de Segur a power plant of 4,000 H.P., which has been put into operation.

The works for the regulation of the Segre river which are rapidly progressing.

From both the electrical works at Seros and Los Terradets, which are about 140 kilometres from Barcelona, two transmissions will be carried on high iron towers, and the electric current, at a tension of 110,000 volts, will be delivered at the stations near Barcelona. The total length of these lines is 369 kilometres, and in addition 340 kilometres of line at a tension of 25,000 volts, and 137 kilometres at a tension of 5,000 volts, will be erected.

A large waterworks on the Ebro is also projected, which will enable a plant of 150,000 H.P. to be erected at Fayon.

The supply of the Compania Barcelonese de Electricidad will be increased from 44,000 to 60,000 H.P., which will be sufficient to supply the Barcelona demand.

Since January 1st, 1912, "La Canadiense" has also supplied current for lighting and power purposes in the manufacturing towns of Tarragona, Reno, Tarrasa, etc. The company estimate the productive capacity of the first of the projected hydraulic plants at 100,000 H.P., of which 85,000 H.P. are already contracted for. A further contract for delivery of 75,000 H.P. has also been made with the Sociedad Iberica del Azoe, to come into operation when the reserve hydraulic plant of the Ebro concession is finished.

The works for the extension of the Barcelona-Sarria railway to Sabedell and Tarrasa are being pressed forward, and it is hoped that traffic on these extensions will be possible next year. The newest enterprise of the Canadiense is the taking over of the three electrical works in Valencia, viz.: the Hidro-electrica del Turia, the Electrica Valenciana, and the Sociedad Valenciana de Electricidad. To illustrate the extent of the operations of Dr. Pearson, it may be stated that the works already carried out or in prospect comprise a total hydro-electric power of 170,000 H.P.

PHYSICAL SOCIETY EXHIBITION.

The Cambridge Scientific Instrument Co., Ltd.

One of the features of this company's exhibit was the electrostatic oscillograph, devised and perfected by Profs. H. Ho and S. Koto, of Japan. For high-voltage work such an instrument embodies important advantages over the electromagnetic oscillograph, perhaps the chief advantage being that the large series resistances necessary for use with the electromagnetic type are not required with the electrostatic instrument, their place being taken by comparatively small and inexpensive condensers.

The vibrator, which we illustrate in fig 1, has approximately the same dimensions as the vibrator of the Duddell oscillograph. The instrument was described in our issue of November 14th.

Some indication of the performance of this instrument may be gained from the following figures. With a natural period of 1/3,300th second, a wave of 2 cm. amplitude was produced at a distance of 70 cm. by a voltage of 2,000 volts effective, the total E.M.F. of the charging battery being 300 volts. By using a high-pressure battery, or an influence machine, extremely small and rapidly-varying currents may be satisfactorily recorded.

Fig. 2 shows the standard coil, designed by Mr. W. Duddell, F.R.S. The special feature of these coils is that porcelain insulation is used both externally and internally in place of the more usual ebonite insulation. The whole coil is enclosed in a metal case filled with selected petroleum oil and hermetically sealed; in this way the coil is made independent of any variation in the relative humidity of the atmosphere. The coils are wound non-inductively with selected silk-covered manganin wire on brass formers, and are insulated by means of porcelain sleeves. The wire is wound in a single layer, so that a maximum cooling surface is obtained and any heat generated by the current through the coil is rapidly dissipated. The accuracy of the coil is within 0·005 per cent. at a temperature of 20° C., the unit being the international ohm. The temperature coefficient is 0·002 per

Fig. 1.—Vibrator of Electrostatic Oscillograph.

Fig. 2.—Duddell Standard Coil.

degree C. With ordinary use the thermo-electric effects between the copper connections and the manganin of the coil are negligible.

The Coblentz linear thermopile, the result of recent researches by Mr. W. W. Coblentz, of Washington, U.S.A., is shown diagrammatically in fig. 3; it is said to be far more sensitive than other thermopiles. The instrument consists of a series of 20 silver-bismuth thermo-couples, with the junctions hammered flat and arranged in the receiver so that all the "hot" junctions lie in a straight line. They are coated on the exposed side with a mixture of lamp-black and

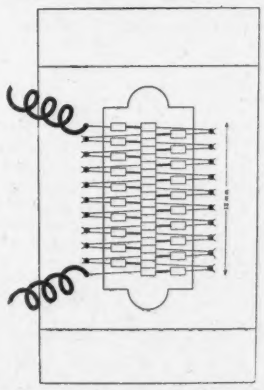


Fig. 3.—Arrangement of Couples in Coblentz Thermopile.

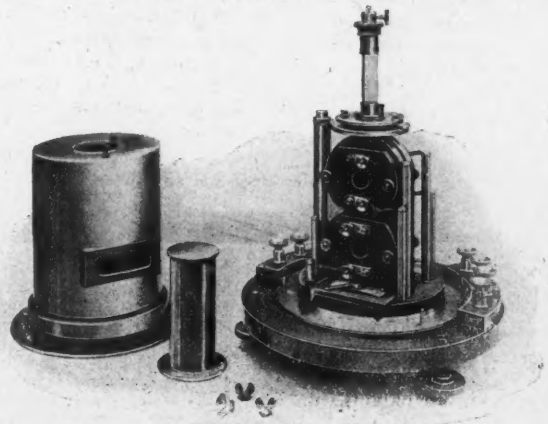


Fig. 4.—Paschen Galvanometer.

chemically-prepared precipitated platinum-black, this mixture giving greatly improved results as regards absorptive power, sensitivity and thermal conductivity in comparison with those produced by a coating of plain lamp-black. The black receiving area is about

12 mm. × 1·3 to 1·4 mm. The respective diameters and lengths of the bismuth and silver wires are arranged to give a maximum sensitivity, the cold junctions occurring alternately on either side of the hot junctions and being protected from external heat rays. The couples are firmly mounted in an ivory frame. Fig. 4 shows the Paschen galvanometer, which was primarily designed for radiometry measurements, and forms with the Coblentz thermopile an exceptionally sensitive and useful combination for radiometry measurements of every description.

Other instruments exhibited were the Lucas contact breaker, designed to open in succession electrical circuits used in physiological investigations at definite short intervals of time, and the Lucas rotating drum, on which records maybe obtained in physiological investigations.

ELLIOTT BROTHERS.

Among other instruments shown by this firm were the latest pattern of their well-known Century standard testing set, a D.C. moving-coil instrument, which can be used either as an ammeter or a voltmeter. The standard pattern has an overall range of from ·001 to 750 volts and ·0002 to 600 amperes. Examples were also shown of their latest pattern of dynamometer movement indicating instruments, for single, two and three-phase balanced or unbalanced working. The movement in these instruments has been entirely re-designed, with the result that a much longer and clearer scale is obtained, and the instruments are now absolutely dead-beat. Examples of chart-recording ammeters and voltmeters were shown, indicating switchboard instruments of various types and patterns, the Century mains testing set, the Wimperis recording and indicating accelerometers, and a variety of Wheatstone bridges and galvanometers, &c.

EVERSHED & VIGNOLES, LTD.

Various recording instruments were shown fitted with the Murday patent pen, which gives rectangular co-ordinates on the chart instead of curved lines; the records can, therefore, be integrated in the ordinary way. When disk charts are used the travel of the pen is radial, giving true polar curves. The "Megger" testing sets were exhibited in operation, the "Bridge Megger" being used to localise faults on an artificial line. Various portable instruments and the "Ducter" potential ohmmeter were included in the exhibit.

GRAHAM & LATHAM.

This firm showed a variety of apparatus for wireless telegraphy, including variable air condensers, receiving sets, detectors, inductances, &c.

PHILIP HARRIS & CO. (1913), LTD.

Galvanometers, resistance boxes, bridges, &c., for use in schools were the electrical features of this exhibit.

LUDGATE WIRELESS CO.

A working exhibit of Mr. L. Miller's wireless transmitter for amateur installations of small power was shown, as well as mercury breaks, induction coils, transformers, &c.

NALDER BROS. & THOMPSON.

The latest type of the "Ohmer," with vibrating reeds to indicate the speed and voltage, was shown together with a number of portable standard instruments of the dynamometer type, for both A.C. and D.C. Fixed instruments of this type were also exhibited, and a large circuit-breaker embodying an improved form of mechanism in the form of a collapsible parallelogram with a light tripping action was a prominent feature of the stand. Great advantages are claimed for this form of gear as compared with the "dead-centre" principle generally employed.

(To be continued.)

THE BRITISH STANDARD SPECIFICATION FOR CONSUMERS' ELECTRIC SUPPLY METERS.

At a meeting of the YORKSHIRE LOCAL SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS, on Wednesday, December 10th, at Leeds, Mr. S. H. Holdon read his paper on the above-named subject (for abstract of paper see ELECTRICAL REVIEW, November 21st, page 810).

MR. T. ROLES said that where strength and shielding from external fields were the main considerations, it was undoubtedly an advantage to have meter cases of cast-iron or pressed steel, but on the adjustment of A.C. meters, it was often convenient to have cases of non-magnetic metal, as the meters could be calibrated without having to replace the cover after each adjustment. The proposed alterations to Clause 6 were urgently necessary. It would greatly facilitate the connecting up of meters if a uniform system of marking the terminals were adopted. Terminal lugs should certainly be provided for meters over the size of, say, 50 amperes. The use of terminal lugs often got over the difficulty experienced in coupling up a small circuit of, say, 3/20 along with a cable of very much larger capacity. The suggestions for modifications in Clause 10 were excellent. However carefully the drilling of the meter cases was done, particles of iron clung to the magnets, and their removal presented such difficulties that it often necessitated readjustment. Much better would it be for the manufacturers to drill the holes before the meter was assembled. He was in agreement with the proposed alteration of Clause 11. He had found so many inaccurate records due to inefficient cyclometer dials, that at present he was not ordering meters with such dials. He preferred the term "kilowatt-hour" to that of unit. He would like Mr. Holden's opinion on the proposed use of the word "Kelvin" in place of unit. He shared the author's opinion as to the permissible losses in the main circuits, and regarded it as a debatable point whether or not a reduction in the pressure coil losses in meters should be obtained at the expense of the meter torque. He regretted that the question of the insulating material had not been taken up. In his opinion, no ebonite whatever should be used. The main insulation should consist solely of mica and steatite, and the use of pressphn should be restricted to positions in which little or no moistnre was met with. In cases where moulded insulators were used for the terminal blocks these should be of a standard pattern, and composed of material of approved insulating qualities capable of withstanding high pressures. The speed of 150 R.P.M. was excessive; it would facilitate the work of testing and reduce friction if it were stipulated that the speed should not exceed 80 R.P.M., and that any speed adopted should be a multiple of 20. The gearing between the rotors and the dials of meters of the same make and size should be uniform; the use of different ratios led to confusion when meters were being tested.

MR. NEVILLE said with regard to Clause 6, that it would be of very great advantage if all the makers would give the same arrangement of terminal blocks and boxes. His experience was that the only makers who made any provision with regard to the labels were the foreign firms, who, presumably, were not covered by the British standard specification; but to put two holes into the meter case would be a very bad practice, because not everybody fixed the label on, and if there was no label fixed on there was a serious temptation to tamper with the meter. The best arrangement was to put the label on the lid of the terminal box. That avoided particles getting on to the magnets.

MR. R. N. CAMPION said he hoped that makers would come more into line, and that the Engineering Standards Committee would complete its investigations. He was not troubled very much with meter errors, because he had found it the best practice to stick to a meter which he found to be reliable, until some fault was found with it. He thought cyclometer dials were more useful than the ordinary dials. He had always been surprised at the liberal design of the manufacturers with regard to the overload of meters.

MR. LONGMAN said there should be a general specification to cover all the meters, and a sub-division distinctly into A.C. and D.C., because when they got on to polyphase they were on quite different conditions altogether. As to the cases, he thought that glass should be retained as a material. With the soft metal case, the Chinaman used to drill a hole and put a hair in, which was so fine that it could not be seen, and then the trick was done, and in future the manufacturers had to supply glass cases. In connection with terminal blocks, he thought that the first thing that should be standardised was the direction of rotation of the armature and the path of the current through the meter, so that they should in all cases be in the same order. There were at present such differences in the arrangement of the terminals that often enough a short circuit was got from the start when fixing. He did not think that more than 500 volts should be allowed upon any meter. If the pressure was above 500 there should be an extra resistance box. He did not think any meter would stand a pressure test of 2,000 volts for 15 min., which was suggested by a gentleman in the discussion at Birmingham. He thought 1,000 for 1 min. was enough. The accuracy of any meter should not be affected more than 1 per cent. by a conductor carrying 2,000 amps. at a distance of 1 ft. away in any possible position. He preferred to use cast-iron or pressed-steel cases for all meters, unless glass was used. They should not go beyond 100 R.P.M., and there, again, there should be a distinction between A.C. and D.C. meters. Forty or fifty R.P.M. was high enough for single-phase meters.

MR. BLAND, as one concerned in the manufacturing interest, said that the B.S.S. was useless for modern practice. Many of the figures were quite wild compared with what at the present time the engineer would demand from the manufacturers. The latter were most anxious to have the co-operation of the engineers in the movement for the revision of the specification. Under present circumstances, the manufacturer who incurred large expenditure in the effort to improve, stood just on the same level as he who made no effort at all. There was room for both cyclometer and clock dials. As to the temperature coefficient, to put it on the front of the case was a most foolish thing, tending to open the eyes of the consumer to a very grave source of error.

The CHAIRMAN (Mr. Woodhouse) said he had been curious to find the basis upon which Mr. Holden had settled the sizes of the holes in his terminals, and had turned to the Institution ratings for that purpose, and been rather surprised to find that Mr. Holden's figures in that respect did not agree with the ratings.

MR. HOLDEN, in his reply, said he thought Mr. Roles did not quite fully appreciate the dangers of non-magnetic cases for meters. An aluminium case could be squeezed with one hand to touch the armature. The case should always be very strong, for the "ingenious Chinaman" was not by any means confined to China. The faking of meters was carried to the point of a fine art in South America, where people went so far as to advertise in the papers devices for making meters read slow. He quite agreed with the importance of a uniform system of position and marking of the terminals, and thought that, for polyphase meters in particular, this was important. With regard to the suggested use of the word Kelvin, instead of kilowatt-hour, the difficulty about adopting that was that he wished to make the British standard specification one of world-wide application. Kilowatt was known everywhere. With regard to what was lost in the pressure circuit, his suggestions were based upon what he believed to be approximately the best standard practice at present. Some provision should be made in the specification limiting very carefully the

range of the insulating materials which should be used. The limitation to 80 or 100 revolutions would be a very good thing, and the manufacturers would soon fall into line with this. A suggestion that had been made for the abolition of the change-wheel in ampere-hour meters was rather a counsel of perfection, though manufacturers would be very glad to get rid of it. He had not wished to suggest that the manufacturers should always put holes in the cases for the customer's label, but only that there should be a standard size of label and a standard position for it. Mr. Longman's suggestion as to subdividing the specification for different classes of meters was a very good one. He would carry it even further, and have other sections for D.C. watt-hour meters and for switchboard meters. As to moulded glass covers, his firm had supplied them, but did not find that there was a very great call for them. The standard direction of rotation and standard direction of current and arrangement of terminals on polyphase meters which had been suggested were most important. He considered it most necessary that a limit on temperature coefficients should be imposed by the B.S.S. As to the defect suggested by Mr. Woodhouse, he did not doubt that Mr. Woodhouse was right.

The discussion then closed.

LEGAL.

EDWARDS *v.* BRIXHAM GAS CO.

(*Concluded from page* 997.)

EVIDENCE having been given by a number of people residing in the neighbourhood of the gasworks as to their experiencing no inconvenience from the working of the engines, MR. W. H. HELLYER, the electrical engineer in charge, spoke to the tests made with the engines, and their working. He took up his duties, he said, in September, 1911, and the generating station was completed shortly after that date. Engine No. 1 was fixed when he went there. No. 2 was there, but its erection was not finished. No. 1 was first run in September, 1911, but the actual trials commenced on December 13th, 1911, and continued until January 2nd, 1912. During that time the engine was run continuously for 60 hours. It was found that the positive battery was not satisfactory at the trial, it had been damaged by sea water. It was taken out and a new set of plates put in. No. 1 engine was then worked for six hours a day on two days a week for the purpose of supplying current to the picture palace. A second trial was started on February 13th, and lasted until the 16th continuously. The negative battery was then charged, and from that day the engine was worked regularly on two days a week. On February 27th they had a further trial with that engine, which lasted until March 1st, and they then charged the new positive battery. The trial of the No. 2 engine began on January 16th, 1912, and after the end of February both engines were worked alternatively for the supply to the picture palace and one or two other places. The exhaust pit was left unfilled in until January 15th, 1912, and, in the meantime, was covered with sheet iron. After that there was practically no noise from it. At the early stages they had some trouble and consequently some noise, but he might safely say that they were all over by March. He had experimented in the engine house by standing coins on edge, while the engines were running and the vibration was not sufficient to cause them to fall. On a glass of water there was just a slight motion discernible.

MR. W. A. SCHULTZ, the chairman of the defendant company, who said he was the director of 10 gas companies, secretary of one electrical company, and director of four others, gave evidence as to the poor nature of the property in the vicinity of the defendants' works. He said he had made tests, but had been unable to detect vibration on the plaintiff's property even while both engines were running. When the electric light plant was installed they employed Messrs. Bridges, and, in his opinion, they could not have engaged better engineers.

Evidence having been given by architects as to the nature of the property and the soil in the neighbourhood of the gas works, Mr. William Henry Patchell spoke to the tests he had made on the plaintiff's property and the defendants' works. He had practised as a consulting engineer since 1906, and in November last he visited the defendants' works, and he got right to the motor house before noticing any signs of vibration. As a result of the tests he had made for vibration on the plaintiff's property, he found it was absolutely undetectable until tests were made by a magnet with mercury.

This concluded the evidence.

MR. PALMER summed up the case for the defence, and submitted on the authorities that plaintiff's remedy, if any, was in damages, and not by way of injunction.

Without calling upon plaintiff's counsel to reply, his LORDSHIP granted the injunction as asked, holding that there was evidence of an actionable nuisance. He, however, stayed the operation of the injunction for three months, to enable the defendants to make the alterations in their plant necessary for complying with the order, with liberty to apply if three months should be found to be too short.

The defendants were ordered to pay the costs of the action.

THE NATIONAL TELEPHONE ASSETS

ON Thursday, December 18th, Mr. Justice Sargant had before him a summons in the matter of the National Telephone Co. taken out by the liquidator for the direction of the Court in dealing with a balance in his hands.

MR. PERCY WHEELER, who represented the liquidator, said that the matter was before the Court last July, when it was held that the surplus assets were distributable amongst the deferred stock holders. They had been so distributed with the exception of about £65,000 which still remained in the hands of the liquidator, who was anxious to part with the fund to the deferred stockholders, but felt it was not quite safe to do so without the direction of the Court, on account of possible claims that might be made against him. A representative of the deferred stockholders had been appointed, and was now represented by Mr. Younger, K.C. The claims that the liquidator felt might be made against the assets were in respect of—

(*a*) Deposits that had been made by subscribers for a telephonic service and had not been returned;

(*b*) Deposits that had been made for the use of trunk lines to avoid payments at the terminal stations;

(*c*) Dividend warrants not presented for payment; and

(*d*) Cheques that have been drawn by the company in favour of creditors and had not been presented for payment.

There were also certain outstanding claims that were now barred by the Statute of Limitations. An order having been made in the winding up requiring all creditors to come in and prove their debts before August 25th last, the necessary advertisements were duly inserted, but some creditors had come in since, and the liquidator having funds in his hands had paid them. Of course, after thedistribution of this £65,000 the liquidator would have no fund remaining.

His LORDSHIP referred the matter to Chambers for inquiry, and directed advertisements of the proposed distribution to be issued.

BIRMINGHAM PRIVATE TELEPHONE (NEW SYSTEM) CO. *v.* HERBERT TERRY & SONS.

ON December 16th and 17th, Mr. Justice Bray and Mr. Justice Lush, sitting as a Divisional Court of King's Bench, heard an appeal from a judgment given in the County Court of Redditch in an action in which plaintiffs, a Birmingham firm, sued defendants, spring manufacturers, of Redditch, for balance of accounts alleged to be due under an agreement for rent of their private installation of telephone instruments, &c., and for damages in respect of alleged breach of an agreement, under which the plaintiffs claimed the right to install 20 instruments. They complained that Messrs. Terry & Sons had only allowed them to provide 17. The defendants entered a counterclaim, contending that they were induced to sign the agreement by misrepresentation on the part of one of the plaintiff company's travellers—a Mr. Ernest Harlow—and they asked for a recission of the agreement. The special jury who in the County Court heard the case returned a verdict which favoured the defendants, but his Honour Judge Ingham granted an application by counsel for the plaintiffs asking for a new trial. From this Messrs. Terry & Sons now appealed.

Mr. Hollis Walker, K.C., and Mr. Gandy were for the appellants—the defendants; and Mr. Maddocks appeared for the respondents.

MR. HOLLIS WALKER said that the action, which was a curious one, ended in a verdict for the defendants, and Messrs. Terry and Sons' complaint was that his Honour not only refused to enter judgment accordingly, but there and then granted an application by counsel for the plaintiff company for a new trial. The plaintiffs, who install telephones and things of that kind, sued the defendants, who had entered into a contract for the installation at their works of a telephone system. There were to be 17 or 20 telephones of an intercommunicating character as distinct from a service with the outside world. Messrs. Terry & Sons, Ltd., paid the contract price of about £25, and subsequently a final bill was delivered containing an entry of something like £65 in respect of "extras." Then it was that the defendants discovered the reason for this apparently extraordinary state of things, and they not only refused to pay the extra charges, but asked that the contract between the parties should be set aside on the ground of alleged fraud. The contract was dated January 24th, 1912, and by its terms the plaintiffs' company undertook to erect and maintain, and the defendants agreed to hire, a telephone installation of 20 instruments, with all accessories. With each instrument the plaintiffs agreed to provide 150 ft. of "single wire" free, and the defendants were to pay for any additional wire required. But what happened, apparently, was that the plaintiffs supplied cables of 22 strands, so that instead of the wire reaching 150 ft. from the instrument, it only ran to the extent of about 7 ft. In this connection the defendants' case was that when they entered into the contract, Mr. Harlow (the traveller) made a statement to the effect that practically no additional wire would be required, and he was alleged to have said this after visiting the works and ascertaining what was contemplated in the way of a telephone system there. On this point, which was an important one in the case, there were really only two witnesses —Mr. Harlow, who declared that he made no such statement, and Mr. Terry (one of the principals in the defendant firm), who asserted that the statement was made, and mentioned the circumstance to show that if it was made it was false. On that the case went to the jury, and Judge Ingham summed up perfectly fairly, telling the jury that it was a case of oath against oath, and properly warning them that they must be satisfied before returning a verdict in favour of the defendants, that the onus of proof

which was upon the defendants had been discharged. The jury found for the defendants, and then the learned Judge, without more ado, and, as he (counsel) submitted, without any proper grounds for so doing, granted an application by the plaintiffs for a new trial.

Mr. Maddocks submitted that the Court had no jurisdiction to vary the decision of the County Court Judge in granting a new trial. There were, he said, some differences of opinion amongst members of the jury on certain points, and his Honour, after hearing arguments, had granted a new trial. He (Mr. Maddocks) contended that the County Court Judge applied a right principle in acting as he did, and quoted authorities in support of his point.

Mr. Walker argued that unless the verdict of the jury was perverse, there was no material on which his Honour could act as he did. He submitted that the County Court Judge did not apply a right rule of law in granting the application for a new trial.

Their Lordships dismissed the appeal, Mr. Justice Bray observing that if they could see that the County Court Judge had acted upon a wrong principle of law, they could set his decision aside because he had gone wrong in the law. But if he had applied a right principle, the Court could not question it, as his Honour had decided a question of fact. In his (Mr. Justice Bray's) opinion, the learned judge did apply a right rule of law, and therefore the appeal could not succeed.

Mr. Justice Lush said he had reluctantly come to the same conclusion, and he only did so because he did not think it was open to the Court, having regard to the authorities, to come to a different conclusion.

Leave to appeal was granted.

BUSINESS NOTES.

Consular Notes.—Japan.—An Austrian report from Japan states that with the increasing installation of gas plants in both the larger and smaller towns in the country there is a profitable business to be done in gas-power engines for the production of motive force. In smaller motors, that is, up to 25 H.P., the Japanese machinery industry is able to supply the demand, and in consequence of the high rates of import duty to shut out foreign competition. In medium sizes, that is from 25 to 50 H.P., there is a keener competition between the home industry and foreign productions. In the larger motors, that is, more than 50 H.P., foreign trade is predominant. In the year 1912, the Japanese imports of gas motors amounted to 1,400,000 yen (about £140,000), and came chiefly from Germany, Sweden, United States and France. The imports from Great Britain were greater than in 1911, and the imports from Germany suffered a diminution.

Montenegro.—The Austrian Consul at Antivari reports that one of the projects which it is intended to carry out as soon as conditions become settled, is the installation of electric light in the town by the Italian harbour and railway company, the "Compagnia di Antivari."

Egypt.—A German Consular report states that there is a considerable demand in Egypt for small motors (petrol motors, Diesel engines and gas engines), small electric motors for works, such as printing works, pumping, &c., dynamos for lighting purposes, and large motors for cotton spinning works and large pumping plants. The imports of these machines in 1911 amounted to £E.414,082, and in 1912 to £E.418,494. Great Britain is the leading supplier of electric, gas and petrol motors, but there is keen competition from Switzerland. German competition in these lines is of comparatively recent date. In other machinery the United States is the chief supplying country. The imports from the United States in 1912 amounted to £E.41,893, as against £E.74,998 in 1911. Whether this decrease is due to the fact that buyers have learned by experience that the cheapness of American productions is off-set by cost of repairs and spare parts made necessary by defective working, and are therefore more disposed to purchase European machinery, or whether the decrease is only temporary, it is, as yet, rather difficult to say. In any case, American firms are taking active steps to recover the lost ground by enabling repairs to be made as cheaply as possible in the country itself, and by endeavouring to educate the native to an expert working of the machinery in order to avoid unnecessary breakages.

Spain.—The British Consul at Seville reports that the Sociedad Catalana de Alumbrado por Gas, which has now changed its name to La Catalana de Gas y Electricidad, after much opposition obtained permission from the Ayuntamiento to lay the electric cables in connection with their proposals to become suppliers of electricity as well as gas. The contract for the supplying and laying of the necessary cables was given to a British company, and work has been steadily progressing. The power station is making progress, but some little time must elapse before the company can supply electricity. As the German company has at present a practical monopoly of the electric lighting, the prospect of competition and a possible fall of prices is an agreeable one for Seville householders.

The Vice-Consul at Cadiz reports that the Puntales station connected by telegraph with the local offices of the Eastern Telegraph Co. and the French Submarine Cable Co., through the Spanish Government telegraph service, is becoming increasingly active, particularly as a large number of vessels, both men-of-war and merchant ships, have during the last year been installed at Cadiz with Marconi apparatus.

The Vice-Consul at La Linea reports that the Compania Peninsula de Telefonos have opened an office in La Linea, and it is now possible to telephone direct to Madrid and many important places in Spain.

Costa Rica.—The British Consul in a recent report refers to the installation of a hydro-electric power plant capable of developing up to 10,000 H.P., by Messrs. Felipe J. Alvaredo & Co., on the Virilla River at San Antonio de Belen, a village 6 miles west of San Jose. Its purpose is the supply of electricity for power, lighting, &c., in the cities and districts in the interior of the country.

Italy.—In reporting on the industries of Turin and district, the British Consul points out that the Province of Novara, which lies north-east of the Province of Turin, possesses some remarkably powerful electric installations. The Conti Electric Power Co. has, besides its installations in Lombardy, generating stations at Cerano, Trecate, Foppiano, Goglio and Novara, utilising powerful waterfalls and provided with machinery of the most modern type. The total power thereby obtained amounts to some 50,000 H.P., which is conveyed to the transforming station at Novara for conversion and distribution in the province and other districts in Lombardy, mains diverging in all directions. The Conti Electric Co. is building another large generating station at Verampio, which is expected to be ready about the beginning of 1915, making use of the Devero waters by a fall of 565 metres, the power obtained being a further 20,000 H.P. When the Verampio installation is in full work, the annual production of electric power at the company's works will be some 200,000,000 KW.-hours.

Mexico.—The American Consul at Acapulco reports that an electric light and power plant has been completed in Acapulco by E. Colima & Companhia, who purchased the equipment in Mexico City, except the poles, which came from San Francisco. Its initial capacity is 2,000 lights of 16 C.P. The municipality has contracted for lights for the streets. The company announces that the wiring and installation of lights will be installed free, but it appears that the high cost of the service will preclude a very general patronage. The cash-in-advance rates per month for lamps run from 8s. 4d. for a 16 C.P. to 33s. 4d. for 100 C.P., and £5 4s. 3d. for 400 C.P., with discounts of 5 per cent. for 5 to 10 lamps, 7 per cent. for 10 to 20 lamps, and 10 per cent. for 20 to 50 lamps. However, the company will probably realise that a meter system will prove more popular. The new plant will provide a market, restricted at first, for many electrical devices. Correspondence should be in Spanish to the company named.

Canada.—The American Consul at Moncton (New Brunswick) reports that the Moncton Tramways, Electricity and Gas Co., Ltd., assumed control in March of the gas and electric light plants, previously operated by the city of Moncton, which were leased for 40 years at an annual rental of about £2,000. New mains were laid throughout the city and from the gas wells, 12 miles away. Natural gas was first used on March 12th; it is now used in about 1,200 households and by 12 industries in developing power in both gas and steam boilers, with satisfactory results. The company uses gas in generating power for the electric light plant and for the street railway. The tramways department operates 3 miles of street railway in the city and 2 miles of the Moncton and Buctouche Railway, which has been electrified to Humphreys Mills, a suburb. Other extensions are contemplated, but are not yet definitely determined. Gas mains were laid from the wells to Hillsboro, New Brunswick, where nearly 500,000 ft. per day are consumed by 175 domestic consumers and two manufacturing plants. It is proposed to lay mains from the wells to Dorchester and Sackville, New Brunswick, and Amherst, Nova Scotia, in the near future. This company imported from the United States during the year three additional street cars, several carloads of gas-burning heaters, stoves and ranges, and meters, tools and fittings. It purchases the gas produced by the Maritime Oilfields, Ltd.

Catalogues and Lists.—Messrs. R. H. Patterson and Co., Ltd., Forth Street Works, Newcastle-on-Tyne.—Catalogue of new and second-hand machinery on sale or hire.

The Hughes Label Co., Ltd., 34, Great Titchfield Street, London, W.—Several lists giving illustrations of labels such as they supply in ivory, celluloid, brass, aluminium, &c., for electrical apparatus, switches, machinery, &c.

Messrs. Krupka & Jacoby, Ltd., 26 to 36, Chapter Street, Westminster, London, S.W.—Leaflets giving illustrations and prices of flat-type tumbler switches and bayonet lampholders.

Messrs. Lead, Ltd., 1 and 2, Old Pye Street, Westminster, S.W.—Leaflet tabulating the cost of depositing lead in varying thicknesses up to $\frac{8}{100}$ in., taking current at 1d. per unit and lead at £22 per ton.

Messrs. James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.—20-page pamphlet containing a number of illustrations showing Keith dust removal plant for use in woodworking and other factories.

The Sirius Autogenous Works Co., 85-87, High Street, Stratford, London, E.—24-page illustrated catalogue fully describing, with the aid of detailed line drawings, their standard and portable acetylene generators for oxy-acetylene welding and cutting.

Messrs. Alfred Herbert, Ltd., Coventry.—December review and stock list of various machine tools.

A.E.G., Berlin.—Leaflets illustrating their steam turbo-pumps dynamos for coupling to Diesel engines, and the "Nitra" lamp consuming ½ a watt per candle.

Holiday Announcements.—Messrs. Ferranti, Ltd., announce the closing of their works and offices from Christmas eve, to Monday morning next, December 29th, and on January 1st, for the Christmas and New Year holidays.

Mr. George Ellison, Victoria Works, Warstone Lane, Birmingham, announces that his works and offices are closed until Monday morning next.

The Edison & Swan United Electric Light Co., Ltd., will open their premises as usual at College Hill and Queen Street, E.C., on Saturday, the 27th inst., for the convenience of their customers.

Installation Contracts.—Amongst the orders recently booked by Mr. H. Moss, Bradford, are the following:—Complete installation for country house, for Mr. W. Briggs; extensions to electric heating arrangements at Bagden Hall, for Mr. T. Norton; extensions to installation in mills, for Messrs. J. Brownhill & Co., Ltd.; power and lighting switchboard, balancers and motors, for Messrs. E. Reed & Co., Ltd., and power, heating, lighting and telephone installations, for Messrs. Tee Bros. & Co.

Calendars and Diaries, &c.—The Hart Accumulator Co., Ltd., of Marshgate Lane, Stratford, London, have again sent us one of their serviceable desk blotting pads.

From the Deutsch-Australische Dampfschiffs-Gesellschaft, of Hamburg, we have received a wall calendar for 1914. The pictorial feature is a representation, in colour, of the *Australia*, and beneath it is fixed a block of daily tear-off slips with bold figuring.

Messrs. Ferranti, Ltd., of Central House, Kingsway, London, W.C., have sent us a useful advertising novelty in the form of a desk paper weight, embodying on the front a calculator for determining the equivalent value of shillings and pence in decimals of a pound, or *vice versâ*, and on the back a mirror, for obvious purposes.

Messrs. Alfred Graham & Co., St. Andrew's Works, Crofton Park, London, S.E., have sent us one of their very handy desk blotting pads with a diary, interleaved with blotting, on the left-hand side. Calendars for 1914 and 1915 are given.

From Messrs. Chas. Clifford & Son, Ltd., Fazeley Street Mills, Birmingham, we have received a phosphor bronze paper knife, which will continuously call our attention to their specialities in phosphor bronze, manganese bronze and gun metal for some time to come, and incidentally will assist us in opening our letters. A postcard from any reader interested in these metals will bring one of these knives along immediately.

Tramcars for Russia.—H M. Commercial Attaché for Russia (Mr. H. Cooke) reports that the Council of Ministers has approved of the proposals of the Minister of the Interior to authorise the Municipalities of St. Petersburg and Samara to purchase electric tramcars from abroad, if necessary. The orders, however, must be given to Russian works if their prices do not differ considerably from the prices tendered by foreign works.—*Board of Trade Journal.*

Annual Dinner.—The staff of Messrs. J. H. Holmes & Co. held their annual dinner on Friday, 12th inst. There was a large and representative gathering, including several former members of the staff. The toast of the firm was proposed by Mr. W. Crosier, foreman, who is the oldest employé at the present time, and during the course of his remarks, some very interesting instances were given of the methods of doing electrical work in the olden days. The toast was responded to with great gusto. Mr. John H. Holmes, when replying to the toast, gave a brief outline of the history of the firm and some interesting reminiscences of work, particularly in connection with installations which were carried out in early days, stating that the first ship to be lighted electrically on Tyneside was ss. *Nonpariel*, this being one of the earliest installations carried out by the firm. As this year is the 30th of the firm's existence, a peculiar interest was attached to the remarks of the chairman. When the new works were first occupied in 1887, the number of hands employed was 42, but this has steadily risen until at the present time employment is found for 670 persons. The illustrated programme and menu, designed by a member of the staff, made a humorous comparison between present-day apparatus and that in use 30 years ago.

Bankruptcy Proceedings.—Roger W. Wallace, K.C., Campden Hill Gardens, Kensington.—Debtor appeared for his public examination on 16th inst. The statement of his affairs showed liabilities £91,987, and an estimated surplus in assets. Debtor, in the course of his examination, gave full information respecting his career, and the profits and losses incurred in connection with the various undertakings. His losses included £30,000 in the Gas Traction Co., Ltd., £10,000 in Dunderland Iron Ore Co., Ltd., £4,000 in Peat Industries, Ltd., and £20,000 in the British Aluminium Co., Ltd. His connection with the Westminster Electric Supply Corporation, Ltd., brought him a profit of £30,000. His directors had brought him as much as £5,000 in one year. Since 1908 he had devoted himself to chemical experiments, registering many patents which were valued in his statement at £73,000. Mr. Wallace mentioned that he had submitted a scheme of arrangement vesting all assets in a trustee for realisation and distribution, with a view to payment being made in full. The examination was concluded.

Charles Blake (Bilston Electrical Co.), 4, Church Street, Bilston.—Receiving order made December 17th at Wolverhampton, on debtor's own petition.

Wire Lamp Patents in Austria.—It is stated that as a result of the objections raised by the Westinghouse Metal-Filament Works Co., the Austrian Patent Office has declared the Austrian patent of the Siemens & Halske Co. in relation to the employment of drawn wire in tungsten lamps to be invalid. The so-called "angle patent" has in part met with a similar fate.

Liquidations.—Universal Cable Code (Parent) Co., Ltd., 22, Henrietta Street, Covent Garden, W.C.—Winding-up order made December 16th

Prested Miners' Gas Indicating Lamp Co., Ltd.—At a meeting of creditors and shareholders held on 17th inst. at Carey Street, the Official Receiver reported that the liabilities were £2,329, and the assets £1,779, showing a deficiency of £18,876. The matter was left in the hands of the Official Receiver.

Book Notices.—*Moderne Wechselstromzähler*, a brochure issued by the A.E.G., Berlin, is an exceptionally handsome production, dealing with the new type of meter introduced by the company to suit the new conditions obtaining in connection with the development of the "overland" system of distribution of electricity. It is beautifully illustrated, not only the details of the instrument (type LJc) being separately shown and described, but also views of the various departments of the meter factory being given. The paper and printing employed are of the highest class, and the brochure, as a whole, is an admirable example of what such a work should be.

The Christmas number of the *Asteroid*, the official organ of the B.T.H. Social Club, contains a great deal of humorous matter in verse, in prose, and by caricaturist, which will be appreciated by those interested in Rugby affairs. The humorous side is allowed to predominate because in their everyday callings "so many of our workers are kept busy at the serious side."

Mechanical World Electrical Pocket Book for 1914. Manchester: Emmott & Co., Ltd. Price 6d. net.—This year's issue contains new sections on a variety of subjects, while others have been completely re-written, and the matter generally has been revised and extended. Even the half-watt lamp, which is not yet on the market, is described, and the book is excellent value for the trifling cost.

Practical Engineer Electrical Pocket Book and Diary for 1914. London: Technical Publishing Co. Price 1s. net.—This pocket-book now deals solely with electrical matters, steam engineering having been eliminated from its pages and new electrical information substituted. A useful feature is the insertion of lists of books at the ends of the sections, which enables readers to follow up a subject if desired. A large portion of the book is devoted to Acts of Parliament, Board of Trade Rules, and the regulations of the Home Office, Lloyd's, the I.E.E., &c. Altogether the pocket-book contains a remarkable amount of information, covering a very wide range.

"Mine Accident Prevention," by D. E. Woodbridge; "Safety in Tunnelling," by D. W. Brunton and J. A. Davis; "The Approximate Melting Points of some Commercial Copper Alloys," by H. W. Gillett and A. B. Norton; "The Use and Care of Miners' Safety Lamps," by J. W. Paul. Washington: Government Printing Office.

"Phase Compensation." By V. A. Fynn. St. Louis, Mo.: From the Author.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXII, No. 12. December, 1913. New York: The Institute. Price $1.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXX, Part 2. December, 1913. Newcastle-upon-Tyne: The Institution. Price 5s.

"*Journal* of the Franklin Institute." Vol. CLXXVI, No. 6. December, 1913. Philadelphia: The Institute. Price 50 cents.

"*Bulletin* of the Massachusetts Institute of Technology." Vol. XLIX, No. 1. December, 1913. Boston: The Institute.

Private Arrangements.—Mrs. A. E. Moore (trading as Henry Moore), ironmonger and electrician, 8 and 9, Longford Buildings, Oxford Road, Manchester, and 38, Wilmslow Road, Didsbury, Manchester.—A meeting of the creditors was held last week, when a statement of affairs was presented which had been prepared by Messrs. Edward Lawton & Son, chartered accountants, 14, Brown Street, Manchester. The statement disclosed ranking liabilities of £659. The assets were estimated to realise £316, less £86 for preferential claims, leaving net assets of £230, or a deficiency of £429. The business was an old-established one, having been commenced some 87 years ago by Mr. Henry Moore's father. The debtor's husband died in September, 1905, and since that time Mrs. Moore had cont nued to trade. A balance-sheet was prepared in 1905, and it showed a surplus, while all the creditors at that time were paid in full. A complete set of books had not been kept, but it was stated that the records showed that the turnover in 1908 was in excess of £1,500. Since that date the sales had declined, and during 1912 they amounted to £1,280. During eight months of the present year the sales had been £620. Owing to pressing creditors a deed of assignment had already been executed to Mr. G. H. Lawton. In the absence of an offer by the debtor it was decided to confirm the deed already executed, and a committee of three of the principal creditors was also appointed.

The Argentine Republic.—The imports of "electrical material and goods" into the Argentine Republic during the nine months ending with September last, are returned at £1,527,000, as compared with only £1,388,000 in the corresponding period of 1912.

LIGHTING and POWER NOTES.

Aberdeen.—The T.C. has decided to supply electricity for power to Messrs. Richards, Ltd., Broadford Works, at ordinary rates up to 100,000 units per half-year, and at ½d. per unit beyond that amount, the agreement to commence in 1914.

Argentina.—The Rosario City Council has, after 14 months' discussion, accepted the tender of Messrs. Colson, Brookhouse & Pyne for a supply of electricity. The concession is for 40 years, after which all the property of the company erected in the first five years of its contract, is to revert to the Council. Direct current at 440 volts is to be supplied for a minimum of 1,000 arc lamps for public lighting. The central station is to have a capacity of 2,500 KW., and the company is to deposit $100,000, returnable when station is opened. The maximum charge for public lighting is to be 34 cents gold per KW.-hour: for private lighting, 15 cents gold; heating and power, 10 cents gold; public buildings, 7 cents gold for light and 5 cents for heating. The Council is to receive 5 per cent. of the gross revenue from private lighting. As the original conditions have been modified, it is not certain that the company will accept them.—*Review of the River Plate.*

Australia.—The Albury Council has accepted an advance of £10,500 for the purpose of an electric lighting scheme. —*Sydney Daily Telegraph.*

Belfast.—WORKHOUSE LIGHTING.—The B. of G. has referred the recommendation of the Watch Committee, that the Workhouse be lighted by electricity on the "Selas" system, at a cost of £4,000, to its engineer for report.

Brymbo.—PUBLIC LIGHTING.—The P.C. has accepted the offer of the Brymbo Steel Co., for electrical street lighting, at £66 per annum.

Buxton.—The U.D.C. has decided to extend the lighting cable to Wye Head, where land is being developed, and houses fitted for E.L. are being built.

Continental Notes.—SWITZERLAND.—The new 13,000-H.P. hydro-electric generating station of the Bernische Kraftwerk Gesellschaft at Kallnach-au-der-Aare has just been put in operation.

SPAIN.—The municipal authorities of Campdevano (province of Gerona) have invited tenders for the concession of the electric lighting of the town.

A private company has been formed at Ochandiano (province of Vizcaya) to supply electricity for lighting and power purposes in that town, and at Olaeta and Ubidea.

La Sociedad Hidroelectrica Espanola is adding to its capital with a view to increasing the capacity of its plant for supplying electricity for lighting and power purposes in Madrid, Valencia, Alcoy and Carthagena, by acquiring the right to utilise the Dos Aguas and Villora Falls, on the River Cabriel, near the town of Villora, in the province of Cuenca. It is estimated that nearly 10,000 H.P. is available.

Delabole.—During the past year a company has been formed for the purpose of supplying Delabole, North Cornwall, with electric light; considerable progress has been made with the works, and it is now probable that the date of opening will be January 10th.

Gelligaer.—The D.C. has decided to apply for a prov. order to supply Bedlinog and Fochriw with electricity, at an estimated cost of about £5,000, if a supply is taken from the South Wales E.P.D. Co., and £3,600 with overhead wires, or £4,000 with underground cables, if taken from the Merthyr Traction and Lighting Co.

Glasgow.—The Electricity Sub-Committee on Works has agreed to recommend that the hiring of electric motors to engineering firms, &c., for use in their works, which had been the practice in the former Burgh of Govan, should not be extended within the Glasgow area of supply, and that the hiring of existing motors be discontinued as opportunity occurs.

Ground plans showing the new generating station buildings proposed to be erected at Dalmarnock, have been approved by the Sub-Committee on Works, and the engineer has been instructed to prepare detailed drawings of the first section of the works. It is proposed that the plant should consist of ten units of 13,000 H.P. each, or a total of 130,000 H.P. The present two generating stations are capable of meeting a demand of 55,000 H.P. Electrical energy is generated at 6,500 volts, and transmitted to substations, where it is transformed to low pressure at 250 and 500 volts.

Harrogate.—Premises in Swan Road are to be opened by the electricity department as a showroom for heating and cooking utensils and general electrical apparatus.

Hinckley.—PROV. ORDER.—Under an agreement with the U.D.C., the Midland E.L. and P. Co. is to apply for a prov. order for electric lighting in the district, which will be transferred to the Leicestershire and Warwickshire E.P. Co.

Hindley.—NEW LOAN.—The U.D.C. has decided to apply for an additional loan of £600 for a sub-station, making the total sum to be borrowed £3,100.

Hornsey.—NEW LOANS.—The B.C. is making application to the L.G.B. for sanction to borrow a further sum of £6,000 for mains extensions.

Itchen.—PROV. ORDER.—The U.D.C. has decided not to sell its prov. order for E.L.

Japan.—It is reported from Tokio that the Fuji Gassed Spinning Co. is in negotiation for the purchase of the electricity undertaking of the Sagami Water Power Co.

According to an official report, the available water power for industrial purposes in Japan is estimated at 3,500,000 H.P., of which only about 200,000 H.P. is at present utilised, but schemes are at present under consideration with regard to a further 1,000,000 H.P.

Hexboro'.—The U.D.C. has decided to charge 1½d. per unit for the first 200 units per quarter, and 1d. per unit above, for heating and cooking.

Newmarket.—PUBLIC LIGHTING.—The U.D.C. has decided to have electric lamps erected in that part of the Avenue taken over by the Council, and the remaining portion of the thoroughfare will be similarly lighted by the owners of the Cheveley Estate. The Newmarket E.L. Co. will supply the posts, &c., and light the lamps for 26s. each per annum.

Rawtenstall.—PUBLIC LIGHTING.—At the T.C. meeting on December 18th, it was resolved at a cost of £2,000 to light by electricity the whole of the main roads in the borough, co-extensive with the tramways, and that a scheme and estimate of cost be submitted; 146 gas lamps will be superseded.

Rochdale.—PROPOSED LOANS.—In consequence of the constantly-growing demand on the electricity department for current for power purposes, it has been decided to recommend the T.C. to apply for L.G.B. sanction to borrow between £50,000 and £60,000 for a further extensions at the works. In the event of the T.C. agreeing, the new application will bring the total outlay decided upon in less than two years to more than £100,000.

Southend-on-Sea.—NEW LOANS.—The T.C. has applied to the L.G.B. for a loan of £30,000 for cables, feeders, mains, connection boxes, &c., for the purpose of suppling electricity in the borough and for a further sum for sub-stations in Leigh and Thorpe Bay.

Stirling.—The T.C. has received a petition from users of electricity in the burgh urging that if the Council is unable to grant the benefits offered by Mr. Balfour—who desires to acquire the electricity station and to institute a system of electric tramways—then the best possible terms should be concluded through Mr. Balfour.

Walsall.—NEW GENERATING STATION.—The T.C. is, says the *Birmingham Daily Post*, considering the scheme, prepared by Mr. E. M. Lacey, for a new generating station. The cost of the new works is estimated at £40,000 to £45,000, and the ultimate cost of reorganisation is reckoned at £70,000. The question has been deferred for the consideration of alternative sites.

Watford.—An agreement between the R.D.C. and the U.D.C. for the supply of electricity within the parish of Aldenham, has been sealed, and the R.D.C. has decided not to consent to the proposal of the Colne Valley E.L. Co. to apply for a prov. order for the supply of energy to the Rickmansworth Rural District.

Weymouth.—NEW PLANT.—The T.C. has decided to install a Diesel engine and generator at the electricity works.

Willesden.—The Electricity Committee has revised the proposed new conditions of supply, which provide for the reduction of the flat-rate charge from 4d. to 3½d. per unit as from the Christmas readings. The Committee has decided to create a reserve fund in connection with the undertaking by the investment of five sums of £1,000 each in various Government or Trustee securities, and will make additions thereto annually until the fund reaches the statutory limit; £3,500 is also to be transferred and designated "Working capital account," and will serve the purpose of preventing overdrafts at the bank in the early periods of each quarter.

On December 13th a number of members of the Council visited the new sub-station at Acton Lane, Harlesden, where three B.T.H. rotary converters, totalling 1,000 KW., with high and low-tension switchgear, have been installed. One of the 300-KW. machines was started up by the chairman of the Electricity Committee.

U.S.A.—The Lake Spaulding dam of the Pacific Gas and Electric Co. has been completed to a height of 242 ft. above the river bed; it is intended to raise it to the enormous height of 320 ft. The water will be used six times in successive power developments before its final use for irrigating some 75,000 acres of fruit land.

In the suits which are being brought by hundreds of manufacturing and engineering firms against the New York Edison Co., it is stated that many New York landlords have a secret system of rebates with the company, by which they purchase electricity at 2½d. per unit and sell it to their tenants at 5d., the object of the supply company being to forestall the installation of individual plants in large buildings. It is claimed that unless this practice is discontinued, manufacturers of individual plants might as well go out of business, as the Edison Co. is thereby able to enjoy a monopoly.—*Daily Telegraph.*

The *Electrical World* recently mentioned that the Commonwealth Edison Co., of Chicago, was supplying the Universal Portland Cement Co. with some 5,000 KW. on an 80 per cent. load factor. This customer is supplied on an off-peak basis, and its requirements amount to about 35 million KW.-hours a year.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—Tramway Loans.—The T.C. has approved of the draft prov. order for powers to construct additional tramways, run trolley vehicles and motor-omnibuses, &c., and proposes to seek powers to borrow £65,000 for the tramways undertaking.

Argentina.—The Legislature of San Luis has granted a concession for 60 years to Mr. Antonio Gamberini for an electric tramway in Villa Mercedes.—*Review of the River Plate.*

Belfast.—It has been decided to go to Parliament for a Bill to sanction the expenditure of £15,000 on the Bellevue Gardens, which are run in connection with the Glengormely line of the tramway system.

Birmingham.—It has been previously mentioned in these columns that the Corporation Tramways Committee had practically arranged to buy up the Birmingham and Midland Omnibus Co.'s undertaking so far as it related to Birmingham.

Recently it has been sought to come to some agreement with the company, by which the country 'bus services between the city and neighbouring towns, which the company proposes to inaugurate next year, shall not compete with the Corporation tramways to the city boundaries. It is believed that the matter will come before the City Council in January.

The Tramways Committee has had under consideration a report on the question of ½d. fares; no recommendation will be made until the close of the financial year.

Bury.—The B. of T. has informed the T.C. that it is now too late to apply for a prov. order in the ensuing session for the tramway extensions, and the Tramways Committee has decided to interview the Board with a view to obtaining consent to the laying of a track in connection with the Limefield extension while certain paving is in progress.

Canada.—In connection with the Mount Royal Tunnel and terminals of the Canadian Northern Railway in Montreal, six 2,400-volt D.C. trolley locomotives are proposed, two coupled together to haul heavy trans-Continental trains of 1,130 tons, and one for freight trains of 1,000 tons, and local trains of 500 tons trailing load. The locomotives are of the box-cab articulated running gear type and will weigh about 83 tons. Four 1,200-commutating-pole motors and a double end multiple-unit control equipment, with air-brake apparatus, are included in the equipment. The signalling system provides for automatically cutting off the power from the motors and applying the brakes, in the event of a driver over-running a signal at danger.

Colwyn Bay.—The U.D.C. has had before it a communication from Mr. A. G. Balfour, general manager of the Electric Railway Co., suggesting consideration of the question of running a single line through into Penrhyn Avenue, to be used as a down track for the trams, the cars running only in one direction on the promenade. The Council is to interview Mr. Balfour.

Continental Notes.—Turkey.—At the recent meeting of the Electric Light and Power Investment Co., held in Berlin, Herr von Gwinner, of the Deutsche Bank, referred to the tramways in Constantinople, and the projected underground and elevated electric railway. He stated that the first section of the tramways in the main street of Pera was opened to traffic some time ago, and the receipts at once increased by two and half times, as compared with those when horse traction was used. The company's interest in the tramways was inconsiderable at the present time, as its share in the concession was disposed of some time ago to the Société Financière, of Brussels, at a profit of 50 per cent., the Belgian company having amalgamated the tramway concession with those for the proposed underground and elevated railway and the electricity works, and that appertaining to the old Stamboul Gas Co. The construction of the railway had not yet been commenced, but the work would be begun as soon as the negotiations in regard to the details of the route had been concluded.

Austria.—A preliminary concession has been granted in connection with a projected electric tramway in the Town of Lemberg, Galicia.

Croydon.—The B.C. has resolved to double the track on the Norwood and Penge route between Selhurst Station and Princess Road, at a cost of £2,550. Councillor Addison alleged that £200 per week was being lost on the route Ald. Allen (Chairman of the Tramways Committee) said that on November 1st the balance was just on the right side. The motor-'bus competition on this route is very severe.

Dewsbury.—Tramway Extensions.—The T.C. has decided to apply for powers to construct a tramway across the Market Place, and to secure running powers over the lines now leased to the National Electric Construction Co., and the B.E.T. Co., from Wakefield Road to Leeds Road, and from the Market Place to Willans Road; and over other sections of the B.E.T. Co.'s lines as may afterwards be determined.

Newcastle (County Down).—Proposed Tramways.—A very important project is on foot in connection with the opening up of the Mourne Mountains by an electric tramway. The Mourne Mountains are one of the finest tourist areas in Ireland, but they are extremely difficult of access by foot. The Urban Council is thinking of putting the project into more tangible form and has had a prolonged discussion of the matter.

South Africa.—In discussing a paper read before the South African Institute of Engineers, it was stated by Mr. J. H. Dobson, general manager of the Johannesburg municipal E.L. department, that the experience gained with their petrol omnibuses showed all-in costs of 1s. 4d. per car-mile, taking the life of the 'bus at only four years. No road maintenance cost or taxes were included in the figure mentioned. He further mentioned that Messrs. A. H. Johnson & Co., of Johannesburg, were placing a battery-driven tramcar at the Corporation's disposal for trial purposes.

South Lancashire.—The South Lancashire Tramways Co. is negotiating with the Salford Tramways Committee with a view to linking up its tramways at Newtown, Clifton, with the Corporation's system at the corner of Station Road, Pendlebury. There is a stretch of 200 yards at this point still unconnected.

Southend-on-Sea.—New Loans.—The T.C. has applied to the B. of T. for loans amounting to £8,750 for doubling the tramway track in Southchurch Avenue, the Broadway, and for £6,000 for laying tramways at Leigh.

U.S.A.—Sir Guy Granet, general manager of the Midland Co., with members of the company's engineering staff, is at present on a tour of railway inquiry in the States, the principal matters of interest being electric traction, freight handling, and, apparently, train lighting.

According to Sir Guy, the Midland is faced (as is known) with the electrification of the Tilbury line, also as a future possibility with the electrification of the 50 miles of main line from London to Bedford, on account of the rapidly-growing suburban traffic. Another attractive proposal mentioned was the substitution of electric for steam traction on hilly sections dealing with heavy goods traffic, with a view to running longer trains than are at present possible.

Sir Guy further pointed out that it might be desirable near London to adopt a system of electrification which could be used in connection with the local underground railways.

West Hartlepool.—New Cars.—The Tramways Committee decided on the 15th inst. to purchase five new tramcars for use on the Park and Seaton Carew route. The estimated cost of the cars, with the necessary spare parts, is £4,480.

TELEGRAPH and TELEPHONE NOTES.

Canada.—About £400,000 will be expended by the Alberta Government on telephone extension work during 1914. This will include the erection of a large number of exchanges.—*Canadian Electric News.*

New Cable.—A contract has been entered into between the Portuguese Government and the Europe and Azores Telegraph Co., Ltd., under which the latter is empowered to lay a submarine cable between the Azores and the coast of North America, and another cable between the Azores and the United Kingdom or some point on the European continent.—*Board of Trade Journal.*

New Telephone Cable.—A new telephone cable is being laid between Howth (Co. Dublin) and North Wales, which is expected to improve the service very considerably. Hitherto, telephone subscribers in Dublin and the South of Ireland, who wished to speak to London, had to do so *via* Belfast and Glasgow, whereby numerous delays were occasioned. The new cross-channel cable is estimated to cost £78,000.

United States.—At the suggestion of the Department of Justice, the American Telephone and Telegraph Co. has agreed to give up its interests in the Western Union Telegraph Co., and to effect a reorganisation, to conform to the department's interpretation of the Anti-Trust Law.

The Postmaster-General, in his annual report, recommends Government ownership of the telegraph and telephone lines.

At midnight on December 31st (by American time), the powerful station near Washington, U.S.A., will issue a wireless message, for which all receivers are invited to listen, with a view to recording long-distance reception.

West Indies.—Last week Mr. Samuel announced that the cable rates between this country and the West Indies would shortly be reduced from 3s.-5s. 6d. to a uniform rate of 2s. 6d. a word; the rate would be halved for Press and deferred plain language messages.

CONTRACTS OPEN and CLOSED.

OPEN.

Ainsworth (near Bury).—January 5th. Electric lighting at the Sanatorium, for the Bury and District Joint Hospital Board. Specifications 10s. (returnable). F. Wild, Clerk to the Board, Cross Street, Bury.

Australia.—SYDNEY (NEW SOUTH WALES).—March 18th.—For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

ADELAIDE.—February 11th.—P.M.G. 50 cable terminals. See "Official Notices" to-day.

MELBOURNE.—February 17th.—P.M.G. Cable boxes. See "Official Notices" to-day.

Bedford.—Corporation. One hand-operated overhead travelling crane. See "Official Notices" December 19th.

Belgium.—December 30th. La Société Nationale des Chemins de Fer Vicinaux, of Brussels, is inviting tenders for the supply of the bronze wire for overhead conductors, required during 1914. Specifications can be obtained for one franc from the address given above.

January 3rd. The Belgian Post and Telegraph Authorities in Brussels (Salle de la Madeleine) are inviting tenders for the supply and laying of a quantity of telephone cables in the Liége and Brussels districts.

January 19th. Antwerp Municipal Authorities (1) for the supply and installation of electrical equipment for two transformer cabins, (2) 70 electric contacts, and (3) armoured electric cables. Tenders to the Burgomaster, Hotel de Ville, Antwerp; deposit 2,000 fr. (£80) in the case of (1); 1,000 fr. (£40) in the case of (2); and 7,000 fr. (£280) in the case of (3). The cahiers des charges may be obtained, price 50 centimes each, at the Hotel de Ville, Antwerp. Copies (in French) may be seen at the Commercial Intelligence Branch of the Board of Trade, London, E.C.—*Board of Trade Journal.*

Bradford.—January 3rd. Corporation. Supply of electric trolley vehicle equipment. See "Official Notices" December 12th.

Carlisle.—December 31st. Corporation. Two 1,250-KW. high-pressure turbo-alternators; two sets of surface-condensing plant; two 600-KW. rotary converters; and high-tension switchgear. See "Official Notices" December 12th.

London.—L.C.C.—January 13th. Installation of 130 lighting points at Popham Road Elementary School, South Islington. See "Official Notices" December 19th.

G.P.O.—January 5th. Telephone silence cabinets, for the P.M.G. See "Official Notices" November 21st.

Northampton.—January 12th. Corporation. Double line of tramways to Far Cotton and doubling of section of Kingsthorpe route, also the necessary overhead equipment, underground feeders, telephones, &c. Specifications (£5 deposit) from Mr. A. Fidler, Borough Engineer, Guildhall.

Southend-on-Sea.—Council. Three single-deck open tramcars which can be covered in during bad weather. The Electrical Engineer, Mr. R. Birkett.

Spain.—Tenders are at present being invited by the municipal authorities of Salamanca for the concession for the supply of electrical energy for lighting and power purposes in the town.

January 1st. Tenders are being invited by the municipal authorities of Umbrete (province of Seville) for the concession for the electric lighting of the town during a period of 20 years.

Swansea.—January 8th. Corporation. One or two years' supply of motors and starting switches. See "Official Notices" December 19th.

CLOSED.

Admiralty.—The Edison and Swan United Electric Light Co., Ltd., has secured the contract for Royal Ediswan drawn-wire tungsten-filament lamps for H.M.S. *Tiger*.

Australia.—N.S.W. Public Works Department:—

Two electric goods lifts, in Argyle Bond, £1,000; two temporary lifts, £55. Standard, Waygood, Hercules, Ltd.—*Tenders.*

The following tenders have been accepted by the Postmaster-General's Department:—

WESTERN AUSTRALIA:—

Telephone material.—Western Electric Co. (Aus.), Ltd.
Condensers, 27,000 porcelain insulators, 5½d. each; 15 miles two-twisted, tinned copper wire, £8 7s. 6d. per mile.—J. C. Fuller & Son (Leslie and Co., Perth).
3 miles silk and cotton-insulated, light lead switchboard cable, taped and braided, 42 conductors, £63 9s. 6d. per mile.—Malloch Bros.—*Tenders.*

Barnes.—The U.D.C. has accepted the tender of Messrs. Pooley & Austin, for a 10-KW. steam set with Reavell engine and Mawdsley dynamo and switchboard, for the clinker-pressing plant, at £141.

Germany.—The municipal authorities of Bremen have lately placed a contract with Messrs. Sulzer Gebruder, of Winterthur, Switzerland, for the supply of two 5,000-H.P. Diesel engines for the extension of the electricity supply undertaking in that city. The engines will be of the six-cylinder vertical type, and will be direct-coupled to 7,000-volt, 50-period alternators. The plant at the generating station at Bremen at present comprises two steam and two water turbines, with generators of a total capacity of 7,500 KW.

Glasgow.—The Tramways Sub-Committee on Works and Stores record the acceptance of the following tenders:—

Telephones.—James M'Millan & Co.
White lead.—Hird, Hastie & Co.
Adhesive tape.—A. Avisine.
Car bells.—Standard Electric Co., Ltd.
Car brake chains.—Weldless Chains, Ltd.
Trolley cord.—W. C. Yuille & Co.; W. G. Black.
Rubbers for snow ploughs.—George M'Lellan & Co.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

WAR OFFICE.

Electric cable.—W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph and India-Rubber Works, Ltd.
Travelling cranes.—Cowans, Sheldon & Co., Ltd.
Dynamos.—Siemens Bros.
Generating set.—W. H. Allen, Son & Co., Ltd.
Telephone sets and parts.—Automatic Telephone Manufacturing Co., Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.; Siemens Bros. and Co., Ltd.; Walter's Electrical Manufacturing Co., Ltd.; West London Scientific Apparatus Co., Ltd.

POST OFFICE.

Telegraphic apparatus.—Gell Telegraphic Appliances Syndicate, Ltd.
Telephonic apparatus.—London Electric Wire Co. and Smiths, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Silence cabinets.—British L.M. Ericsson Manufacturing Co., Ltd.; Siemens Bros. & Co., Ltd.
Telephonic cable.—Callender's Cable, &c., Co.; W. T. Henley's Telegraph Works Co., Ltd.; Peel-Conner Telephone Works, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Dry and Leclanché cells.—Siemens Bros. & Co., Ltd.
Earthenware ducts.—Doulton & Co., Ltd.
Telegraphic ironwork.—Ballers, Ltd.; T. W. Lench, Ltd.; E. Lewis and Sons.
Bronze and copper wire.—T. Bolton & Sons, Ltd.
Enamelled copper wire.—B.I. and Helsby Cables, Ltd.; London Electric Wire Co. and Smiths, Ltd.
Galvanised iron wire.—Rylands Bros., Ltd.; Whitecross Co., Ltd.
Electric lighting at Leeds New Telephone Exchange.—G. E. Taylor and Co., Ltd.
Manufacturing, supplying, drawing-in, and jointing cable; Eastern, South-Eastern and London Engineering Districts.—Callender's Cable, &c., Co., Ltd.; Siemens Bros. & Co., Ltd.; Johnson & Phillips, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.
Private branch exchange extension at Harrods, Ltd., Brompton Road, S.W.—Western Electric Co., Ltd.
Telephone exchange equipment at Greenwich.—Peel-Conner Telephone Works, Ltd.
Telephone exchange equipment extension at Worcester.—Peel-Conner Telephone Works, Ltd.
Telephone exchange equipment (trunk) at Leeds G.P.O.—Siemens Bros. and Co., Ltd.
Laying underground conduits, manufacturing, supplying, drawing-in and jointing cable at Scotland Engineering Districts.—W. T. Henley's Telegraph Works Co., Ltd.; B.I. and Helsby Cables, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.; Callender's Cable Co., Ltd.

INDIA OFFICE, STORE DEPARTMENT.

Dynamos.—J. Stone & Co.
Electrical plant.—British Thomson-Houston Co.
Motor alternator.—Lancs. Dynamo, &c., Co.
Wire.—R. Johnson & Nephew.

London.—HAMPSTEAD.—The B.C. has accepted the tender of Messrs. E. Foster & Co. for 10,000 tons of Ibstock deep small peas, at 13s. per ton.

Southend-on-Sea.—The T.C. has accepted the following tenders in connection with the new motor-'buses:—

W. A. Stevens, Ltd., Maidstone.—Three petrol-electric chassis £690 each.
Straker & Squier, Ltd., Blackfriars.—Three petrol chassis, £680 each.
Brush Electrical Engineering Co., Ltd.—Three front-seating car bodies, £180 each; and four with side seats, £180 each.
Edison Accumulators, Ltd.—Electrically-driven chassis, £825.

The Council has also accepted the tender of Messrs. Edgar Allen and Co., Ltd., for cross-over materials for the tramways, at £620.

Weymouth.—The T.C. received the following tenders for wiring for the E.L. the premises at 3, Devonshire Buildings:—

J. H. Rankin	(accepted) £20
C. Tett	23
W. D. Orchard	41

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Friday, December 26th. At 6.15 p.m. At the Institute. Annual Social.

Royal Institution of Great Britain.—Saturday, December 27th. At 3 p.m. At Albemarle Street, W. Juvenile lecture, first of a series on "A Voyage in Space," by Prof. H. H. Turner.

Electro-Harmonic Society.—Friday, January 2nd. At Holborn Restaurant. Smoking Concert.

Junior Institution of Engineers.—Friday, January 2nd. At 8 p.m. At 39, Victoria Street, S.W. Paper on "Electric Cooking." By Mr. E. J. Haselton.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued:—

Monday, January 5th.—"A" Company. Technical instruction, 7 p.m. to 10 p.m.

Tuesday, January 6th.—"B" Company. Ditto.

Wednesday, January 7th.—Recruits only. Infantry drill and technical instruction, 7 p.m. to 10 p.m.

Thursday, January 8th.—"C" Company. Technical instruction, 7 p.m. to 10 p.m.

Friday, January 9th.—"D" Company. Technical instruction, 7.30 to 9.30 p.m. Special class on Crossley engine, 7 to 8 p.m.

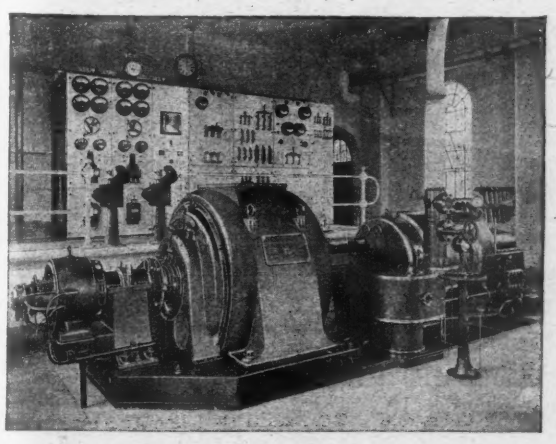
Saturday, January 10th.—Headquarters will be opened for regimental business only from 10 a.m. till 12 noon.

(Signed) F. R. Holt-Whyte, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

NOTES.

Colliery Exhaust Steam Plant.—There has recently been installed at the Manners Colliery, Ilkeston, a steam turbine plant to utilise the exhaust steam from various main engines, which steam had previously blown to atmosphere; practically the whole of the electrical power required in the colliery is now obtained by this means. The accompanying illustration gives a view of the power house which contains a 300-kw. Witton-Belliss turbo-generator, generating three-phase current at 440 volts, 25 cycles, and running at a speed of 1,500 r.p.m., and a small reciprocating set comprising a 150-kw. Witton alternator driven by a Belliss engine at 375 r.p.m., which takes the lighter load at nights and at times when the plant which ordinarily supplies the exhaust steam is not at work.

The exhaust steam is led to a central reservoir consisting of a number of old boilers which have been turned to account. The condensing plant consists of a Ledward & Beckett ejector condenser with a spray cooling pond; the generators supply power to



300-kw. Witton-Belliss Exhaust Turbo-Generator, and G.E.C. Switchboard, Manners Colliery, Ilkeston.

an open-type G.E.C. marble switchboard, which includes, amongst the usual complement of instruments, a leakage indicator and a voltage regulator. The colliery works with an insulated neutral. A small cloth filter has been included to filter the air for ventilating the generating plants. The power house electrical equipment was supplied by the General Electric Co., of Witton.

An Acid-proof Material.—According to an article by Prof. Matignon, in *La Technique Moderne*, Dr. Carlo Rossi, manager of a nitric acid works at Legnano, has produced with the aid of the electric furnace a new substance, which he calls Elianite, and which is proof against all acids. Compared with cast-iron, élianite has about three-quarters the tensile strength and a quarter to three-quarters the resistance to compression; its electrical and thermal conductivities are 20 per cent. lower, but its hardness is 1·6 times that of cast-iron. Its density is slightly less. The melting point of élianite is 1,400° C. The new material casts well, and is suitable for the construction of apparatus of large dimensions for the concentration of nitric acid in vacuum pans by steam heating, a process which will facilitate the production of fuming nitric acid required for the manufacture of explosives. Prof. Matignon states that the new substance probably consists essentially of a ferro-silicon, and, therefore, is readily attacked by alkaline solutions; but to the acid manufacturing industries it will be of the greatest importance, enabling many processes to be adopted which have hitherto been impracticable for want of a suitable material.

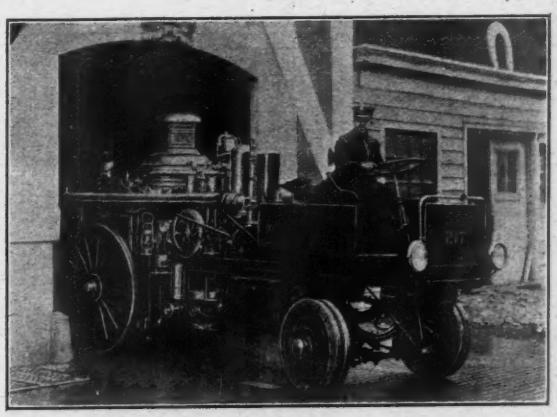
Chambers of Commerce and Income Tax.—The Executive Council of the Association of Chambers of Commerce of the United Kingdom some time ago appointed a special Committee to consider what representations should be made to the Board of Inland Revenue as the outcome of certain resolutions that were passed at the annual meetings in 1912 and 1913 with regard to depreciation and other matters. The result of the deliberations is that the Committee agreed that representations should be made on the following questions:—

1. Allowance for depreciation of buildings and other structures.
2. Allowance for depreciation of wasting assets, shaft sinking and development, furniture, fixtures and fittings.
3. Allowance for expenses of removal and rearrangement of plant and machinery.
4. Increased allowance for depreciation in respect of machinery in operation day and night.
5. Regularisation of rates of depreciation allowed in different trades.

The Committee also suggest for the consideration of the Board of Inland Revenue:—

1. The consolidation and amendment of the Income-Tax Acts in force and incorporating either in the Act or in the rules and schedules the instructions issued from time to time by the Inland Revenue to its officials as to their duties and the rules for calculating deductions from depreciation.
2. Assurance in all districts of continuity of policy in practice and administration.
3. All earned incomes, whether from trade or employment, should be assessed under Schedule D.
4. The allowance of formation expenses of joint-stock companies and expenses incurred in issuing further capital as deductions, as well as all expenses or losses incident to carrying on a business, and which either by law or commercial usage must be met out of profits before dividends can be declared to shareholders.

An Interesting Electric Motor Fire Engine.—Like most of the leading fire brigades in the world, the equipment of that of New York is being rapidly converted from horse to motor traction. In connection with the change, the New York authorities have carried out an interesting experiment—that of converting one of the old horse-drawn steam fire engines to electric traction. The vehicle, which had previously seen 10 years' service, was converted by the Couple Gear Freight Wheel Co., of New York, who removed the old front portion of the machine and replaced it with steering gear and a front axle with two hub electric motors, and an 80-cell storage battery divided into two sections. The vehicle, for the accompanying illustration of which we are indebted to the "Edison Monthly," was put in service in April, 1912, and during the ensuing 12 months, it was called out to 319 fire alarms, covering approximately the same number of miles. No mileage record was kept, but a mile for each alarm is considered a fair average.



Horse-drawn Fire Engine, converted for Battery Traction.

During the 12 months, energy to the extent of 1,965 kw.-hours was consumed in charging the batteries, the cost of the same being £24 10s. Added to this was £14 15s. for sundries, and £40 for depreciation, making the total cost of motive power for the apparatus for the year just under £80. For comparison, the fire department officials prepared a table showing the cost of horses for a similar vehicle. The principal item is that of feed—£85 11s. Added to this is £4 7s. 6d. for veterinary service, £17 14s. 6d. for shoeing, and £28 16s. 6d. for depreciation, making a total of £136 9s. 6d. These figures, which are based on the performance and cost of keeping three horses, show that there was an economy of roundly £56 in favour of the electromobile. During its first year there was not a single instance of damage to the electrical equipment of the machine, although street accidents necessitated some repairs to the mechanical portion. More than 14 hours were spent at fires during the 12 months, and approximately 230,000 gallons of water were pumped.

The World's Hydroelectrical Resources.—From statistics collected by De la Brosse, it appears that the water powers available for electric generation in France range in the aggregate between 4,000,000 h.p. in the lowest water period, and

8,000,000 H.P. in the highest water period. These are distributed in the three chief regions of France. The following figures give the water-power in H.P. at lowest water :—

Alps and Pyrenees	2,300,000
Middle and East	900,000
Other regions	1,400,000
Total	4,600,000

The extent of the present utilisation is 600,000 H.P. Installations under construction, or contracted for, represent 145,000 H.P. and projected, 635,000 H.P. These are allocated to the various regions as follows :—

—	Utilised H.P.	Employed for			Sundry H.P.
		Electro-chemistry. H.P.	Electro-metallurgy. H.P.	Light and power. H.P.	
Alps	473,000	60,000	210,000	195,000	8,000
Middle region...	51,000	—	1,000	50,000	—
Pyrenees ...	55,000	10,000	10,000	35,000	—
Other regions...	21,000	—	—	21,000	—
	600,000	70,000	221,000	301,000	8,000

The value of the water power installations is shown by the amount of share and bond capital of the several concerns. It appears that power and railway companies stand for 430,000,000 francs. The value of the electro-chemical and electro-metallurgical undertakings totals 110,000,000 fr. The value of French undertakings consequently aggregates 540,000,000 fr.

These figures compare with the available and utilised powers of foreign countries as under :—

Country.	Water-power capacity at the turbine axles. Available.	Used.	Percentage of utilisation.
Great Britain	963,000	80,000	8·3
Germany	1,425,000	445,000	31·2
Switzerland	1,500,000	380,000	25·0
Spain	5,000,000	130,000	2·6
Italy	5,500,000	510,000	9·2
France	5,587,000	600,000	10·3
Austria-Hungary	6,460,000	515,000	8·0
Sweden	6,750,000	550,000	8·2
Norway	7,500,000	550,000	7·3
Europe, total	40,955,000	3,760,000	9·2
United States	30,000,000	2,000,000	6·6
Japan	—	65,000	—

The stimulus which electricity must prove to the industrial development of countries barren of coal resources is very evident from the above statistics.

Peat as Station Fuel.—The generating station on the Wiesmoor in East Friesland, which has now been in operation for a period of about two years, and which has been referred to on former occasions, was designed for the purpose of utilising peat as the boiler fuel, and at the same time to open up the moorland to agricultural operations. The nearest locality to the station is Aurich, which is nearly 14 miles distant, and not a single district exists in the vicinity which promises to become a good customer for the supply of electrical energy for its industries. According to an article in the *Technische Rundschau*, by Prof. J. Teichmüller, the peat has to be kept in considerable quantities in a very dry condition ready for use, if there is not to be a shortage of fuel at the end of the winter, when the beginning of the peat production campaign commences. In addition to large stacks of peat briquettes which are accumulated, a peat shed having a storage capacity of 2,000 tons is provided in the station, and a second shed adjoins the boiler house. At the outset the conditions attending the firing of the boilers did not permit of the utilisation of the fuel so as to obtain a high degree of efficiency, but after trials extending over a considerable period, it was found possible to reduce the consumption of peat first to 5·9 lb. per KW.-hour, and finally to 5·5 lb. per KW.-hour. With peat at a price of 5s. per ton, these figures represent a cost of ·156d. per KW.-hour for fuel, which is held to afford proof that a peat fuel generating station can be worked successfully on an economic basis.

The generating plant comprises four steam turbo-dynamos, each of 1,500 KW., and generating energy at 5,000 volts, which may be transformed up to 20,000 volts. The overhead network is carried on wooden masts which have been bedded in the sub-soil of the moor—an operation which was extremely difficult to carry out, in consequence of the nature of the soil. The peculiarity of the undertaking lies in the cultivation of the moor simultaneously with the winning of the peat. For the former purpose the drainage of the moor comes first into consideration, and wide and navigable canals are being made which receive the water collected by a network of drains, and which convey the water to public canals. When sufficiently drained, the moor land is ploughed, and harrowed and fertilised, and then sown with the first seed. The drainage canals are excavated by two peat dredgers, and 12 so-called peat machines. After the top layer of "white moor peat" has been removed by hand labour—it is of no use as fuel—the dredgers are brought into operation, the buckets being driven by an electric motor, whilst a second motor provides for horizontal movements. The wet peat is conveyed to an electric press, and the cakes made are placed on the surface of the drained moor to dry. The cakes are subsequently cut by machinery into briquettes, and, when completely air-dried, although still containing from 20 to 30 per cent. of water, they are transported on a field railway equipped with benzol locomotives, for direct use in the power station, or for storage in the sheds.

The peat machines work in connection with elevators, similarly to the dredgers, but deliver the peat from the presses in the form of briquettes, which are laid out by labourers on the drained moor to dry. Only the months of April to August are available for the collection of the peat, as frozen peat is unserviceable as fuel. If wet weather prevails about the end of the summer the laid-out peat absorbs water, and if it does not become dry again before the arrival of frost, the latter renders it useless. On the other hand, completely air-dried peat does not freeze and does not absorb water, and it can, therefore, be arranged in stacks for the whole of the winter. The Wiesmoor has an area of about 15,000 acres, and the peat a thickness on an average of 8 ft. But even from the canals alone, which have a length of 36 miles, it is calculated that the available peat will suffice to supply the electricity works with fuel for a period of 20 years, if the disposal of electrical energy in this time should grow to an average of 20,000,000 KW.-hours per annum, or to two and a half times the amount of the present production. On the completion of the canals the remainder of the area, which in the meantime will have been under cultivation for agriculture and fruit and cattle raising, will be worked for the peat deposits. But the final goal is the cultivation of the moorland when stripped of the peat. It is considered that settlers will be easily obtainable for the winning of the peat and its remunerative sale to the electricity works, and that an area of from 12 to 17 acres will provide a living for a family of five persons without requiring outside assistance.

Electric Vehicle Committee.—The third meeting was held on December 11th. A letter was read from the Chief Commissioner of Metropolitan Police, regretting that he was unable to accept the invitation of the Committee to become a member of it. A letter was read from the Incorporated Motor Users' Association, asking that they might be represented on the Committee, and as a result Mr. E. S. Shrapnell-Smith, the treasurer of the Association, had been appointed for this purpose. The Sub-Committees appointed are as follows :—

Technical.—R. A. Chattock, F. Ayton, J. E. Edgcome, R. E. Mossay, E. S. Jacob, Conway Jenkins, J. Christie, W. H. L. Watson, and a B E.A.M.A. representative of the Dynamo and Motor Section and of the Switchgear Section.

Commercial.—R. A. Chattock, F. Ayton, F. E. Gripper, E. S. Shrapnell-Smith, A. H. Seabrook, A. C. Cramb, H. Faraday Proctor, W. S. Naylor, J. F. Monnot, W. R. Rawlings, J. S. Highfield.*

The following matters were referred to the Technical Sub-Committee :—

1. Arrangements to recommend for Charging Batteries.
2. To decide upon the most suitable sizes of a line of charging outfits : (A) for D.C. systems ; (B) for A.C. systems.
3. Instructions for Charging Batteries.
4. Rules for use in maintenance of Electric Vehicles.
5. Standard Ratings for Motors.
6. Standard Battery Voltages.
7. Standard Ratings for Commercial Vehicles.
8. Wiring Details.
9. Standard Charging Plug and Receptacle.
10. Standard Battery Units.
11. Electric Lighting on Vehicles.

To the Commercial Sub-Committee the following matters were referred :—

1. The drafting of a circular letter to Electric Supply Undertakings in regard to Provision for Charging Facilities, Tariffs, Publicity, &c.
2. Insurance Rates.
3. Parades and Exhibitions.
4. To collate information and publish same.
5. Taxation Matters.
6. Issue of Maps and Lists giving information *re* Charging Stations.
7. Preparation and publication of Publicity Matter, Advertising.

As it would be an advantage in the future if the standard plug and receptacle could be made an international one, the secretary was directed to get into touch with the German and French Institutions of Electrical Engineers, in order to ascertain whether such a proposal would have their support.

Ozone.—Writing to the *Times* of December 16th, Dr. Leonard Hill refers to the adverse criticism of certain American scientists, and says that animals exposed for nine hours each day for a fortnight to a concentration of ozone much higher than is used in ventilation, suffered no harm and put on weight like control animals.

The health of the Central Tube Railway men shows that the weak concentration of ozone there used has had no ill effect. The proved fact remains that ozone abolishes our power to smell almost all the evil trade smells, and in a concentration which does no harm. The American authors are perfectly right in insisting that ozone should not be used in schools, &c., in place of an adequate

* Elected to represent Inc. Assoc. of Electric Power Companies.

supply of fresh air. Fresh cool moving air is essential for the maintenance of vigorous health. But there are, unfortunately, numerous places in our cities where the unpleasant smell and monotonous depressing quality of the air cannot be remedied wholly by ventilation.

"It does not matter in the least whether ozone destroys the smell or prevents our smelling it; if it takes away a monotonous and depressing sensation it does good. The other day I had a he-goat in my laboratory, and its smell was overpowering and most unpleasant. A few minutes' run of an ozone apparatus freed the room from smell, and made it pleasant. There can be no doubt that the unpleasant smell of the Central London Tube Railway has been very largely removed by the use of ozone, and having determined, and insisted on, the provision of a safe concentration there I can see no harm in its employment."

Institution and Lecture Notes.—DERBY SOCIETY OF ENGINEERS.—The syllabus of the Society for the current session includes an item for February 10th entitled "Notes and Experiments in Wireless Telegraphy," by Messrs. S. G. Taylor and A. T. Lee. The booklet containing the rules of the Society also sets forth particulars regarding the Derby Wireless Club (there are about 30 stations in the district) and a number of other local societies, with an engagement memorandum book, quite a useful combination.

ASOCIACION ARGENTINA DE ELECTRO TECNICOS.—On October 18th last, this society was constituted, with a list of 200 adherents, to bring together all those connected with or interested in electrical enterprise in Argentina.

INSTITUTION OF ELECTRICAL ENGINEERS.—At the opening meeting of the STUDENTS' SECTION, on November 26th, an address was delivered by Dr. C. V. Drysdale, on "Food Supply and the Electrical Engineer." Dr. Drysdale said that the Birkeland-Eyde system now utilised about 300,000 H.P. of water power, fixing about 35 million pounds of nitrogen annually. Another process was the production of calcium cyanamide by the Franck Caro method. About 90 million pounds of nitrogen were now annually fixed by this process, making about 125 million pounds in all. This amount was only sufficient to increase the world's harvest of cereals by less than 1 per cent., and the needs of an unrestricted population would demand a present increase of 30 per cent., and a 4 per cent. further increase each year. There was, therefore, little likelihood of supply equalling demand. Suggestions were made as to the utilisation of electrical power for ploughing and subsoil treatment for "dry farming," for increasing rainfall, electrolysing the soil, supplying ultra-violet radiation, &c. The possibility of employing the solar energy directly for the fixation of nitrogen was also considered.

CORNISH INSTITUTE OF MINING, MECHANICAL AND METALLURGICAL ENGINEERS.—On December 13th the Institute discussed two papers, recently read—one by Mr. L. A. Hards on "The Application of Electricity to Mines," and one by Mr. R. D. Gill, on "Comparisons of Costs of Mine Power."

JUNIOR INSTITUTION OF ENGINEERS.—A paper was recently given on the subject of "Efficiency of Production," by Mr. H. N. Munro, who pointed out that England's supremacy as a manufacturing country depended upon her status in the world's market. The factors influencing this status, which is dependent on our efficient production, were discussed seriatim.

INSTITUTE OF METALS.—The annual general meeting will be held at the Institution of Mechanical Engineers, Westminster, on March 17th and 18th, 1914. The annual dinner will take place on March 17th, 1914. The Fourth May Lecture is to be delivered by Prof. E. Heyn, of Berlin, early in the month of May, and will deal with the subject of "Internal Strains in Cold-Wrought Metals and Some Troubles Caused Thereby." The Institute has just published a volume entitled "The Second Report of the Corrosion Committee," which contains, in addition to the report, a verbatim account of the discussion that took place at the recent Ghent meeting, together with many additional contributions to the discussion made subsequently by correspondence.

A paper on "The Desirability of Electrification of Railways" was read by Mr. W. T. Wardale, of Sheffield, at a recent meeting of the HUDDERSFIELD ENGINEERING SOCIETY. Mr. Wardale urged the electrification of railways to cope with the greater speeds required, the safety of passengers, and heavier trains which had to be hauled, whilst he also pointed out that a matter of great importance was that the signalman would have apparatus to hand which would control trains in the section governed by his signals. The driver, under the electric system, would be able to devote his whole attention to watching the signals.

SOCIETY OF ENGINEERS (INCORPORATED).—The annual general meeting of the Society was held on the 8th inst. It was announced that Mr. H. C. H. Shenton was elected President. The report of the Council dealt with the many activities of the Society, and referred particularly to the consideration that was being given to the status of the engineering profession.

Strike at Schenectady.—The *Electrical World* states that on December 1st the employés of the General Electric Co. returned to work. There was no disorder during the strike, or rather the "demonstration," as the men called it. The employés' committee was satisfied that there was no intentional discrimination against individuals, and admitted that the strike was due to a misunderstanding.

B.E.A.M.A.—At the Council meeting held on the 18th inst., the following firms were elected members of the Association:—Fraser & Chalmers, Ltd.; Johnson & Phillips, Ltd.; Thomas Kesnor & Co., Ltd.; and the Record Electrical Co., Ltd.

Rubber.—The commodity market has been quietly steady on the whole, but the last auctions provided a complete sufficiency of raw material for the use of consumers, and as the tendency on the part of users was rather to hang back for the time being, there was a slightly easier tone as the sales progressed, and the best figures were not fully supported at the end. There was, nevertheless, a pretty good tendency at the close of the sales. Buying will naturally remain of a restricted order now until the way is clear into the New Year. The fact that 1914 will probably witness a considerable further increase in the quantities of rubber coming forward available for disposal at the periodical sales appears in no way to weigh upon the position. With the final sales of the year, held on December 31st, the new conditions of sale agreed upon come into force, and these, which mean that all prices will be net, involve a difference of about 3 per cent. on all grades. There is a good deal of curiosity as to the way in which matters will shape during the New Year, and opinions are rather divided as to the effects which may be expected to follow from the changes in contemplation regarding the handling of the material offered at the sales, and as to the standardisation proposals. A further point is that the future of supplies may be affected materially by the reduced duties on rubber from the Acre district, which come into operation at the beginning of the New Year. It is the firm impression that these will have the effect of greatly stimulating the exports of rubber from this district to Europe and the United States, and no doubt this will prove to be the case, but it is yet to be remembered that at round to-day's selling rates the collection of wild rubber can hardly present many inducements, and that taking the Amazon Valley as a whole there can hardly be expected to be any substantial expansion in the total gathered. The cost of producing the wild article is far ahead of that involved in the scientific cultivation and preparation of rubber as practised on the better class plantations in the Middle East, while in the matter of reliability and actual yield of rubber, the plantation product is steadily taking a higher and higher place. The standardisation proposals are very much to the fore now, and there is not the least doubt that some important results will accrue from the deliberations regarding the investigations which have been made into the question. The main thing which it is sought to ensure is the uniformity of quality of the plantation product, one of the chief drawbacks to its use having been its extremes of variability, and any common action which may reduce this to narrow proportions, and thus allow the buyer to know that in buying he is obtaining an article suitable to his requirements and agreeing in its properties with apparently similar material purchased by him, is a boon. That irregularity in quality is preventible there can be no serious doubt, and that it must be removed and a standard type article substituted, there is equally no question. The only thing is, how long the methods now being condemned by force of public opinion can be permitted to survive. The chief reform desired is without question the standardisation of the rubber. When once this is settled there will be time and opportunity to take other matters of a less urgent nature in hand, though with standardisation there must also be reform as regards grading. The New Year will certainly see big strides made in these matters, and greatly to the benefit of the plantation industry at large.

Electric Cooking at Victoria, B.C.—Mr. Halls, manager of the light and power department of the B.C. Electric Railway Co., writing, in response to a request, in the *Journal of Electricity, Power and Gas*, says the accounts of 20 customers selected at random, but representative of the rest, were analysed. They show a total connected load of 74·5 KW., or an average of 3,725 watts per customer, the maximum load being 4·5, and the minimum 2 KW.

From January to June of this year, both months inclusive, their average monthly consumption was 86 KW.-hours per customer, the highest individual average being 184 KW.-hours, and the lowest 45 KW.-hours per month, with an average monthly consumption of 23·2 KW.-hours per connected KW. The lowest amount paid during that period, was a bill for $1.75, the minimum charge on a small connected load and the highest, $12.45, the load being 4·5 KW.

On account of the minimum charge made, the average price over the period and for the customers considered was 5·44 cents per KW.-hour. The highest earnings per month per connected KW. was $3.00 on a load of 2 KW., and the lowest 65 cents on a connected load of 4·5 KW., the average earnings per connected KW. being $1.26 per month. The smaller connected loads show the best average earnings.

There seems to be but little influence of the seasons upon the current consumption. The highest monthly total was in January, the next highest in June, and the lowest in May, although February, being a short month, was not less than the average.

The average KW.-hour consumption per customer by months in 1913, was as follows:—

January	97	April	82
February	80	May	79
March	87	June	90

The cooking rate which is 5 cents per KW.-hour, with a minimum charge of 75 cents per connected KW., has met with universal favour.

Appointments Vacant. — Assistant engineer for Southern Nigerian Government (£300 +). Particulars are given in our advertisement pages.

Inquiries.—Makers of, or British agents for, "Vita" electric liquid heater; makers of Maclean's patent electric hair brushes are asked for.

Humphrey Pump Tests.—The official tests of the Humphrey pumps at the Metropolitan Water Board's Chingford works have been carried out, with very satisfactory results. The large pumps were specified to lift 40 million gallons a day, and in practice lifted 47·5 millions on the average; the smaller 20-million-gallon pump discharged 26 million gallons. The average fuel consumption of the four large pumps was ·93 lb. per W.H.P., and of the small pump ·8 lb.; the fuel was anthracite, and the tests covered six-hour periods. It may be noted that the valve area of the small pump is relatively greater than in the case of the large pumps.

Electricity at $111 per KW.-hour.—The central station customer who thinks he is paying a high rate for his electricity might, with profit, follow the calculations sent us by a correspondent who has figured $111 per KW.-hour to be the cost of the energy consumed in the average pocket flash-lamp. Such a flash-lamp is sold at 50 cents, while a renewal of the three miniature dry cells usually costs 25 cents. The little filament takes about 0·25 ampere, and the battery supplies 3 volts. Used daily such a battery will be found to be exhausted in, say, two months, or after a total of 180 minutes or three hours' operation. The output of the cells has, therefore, been 3 volts × 0·25 ampere × 3 hours, which equals 2·25 watt-hours. At this rate of 25 cents for 2·25 watt-hours, the cost of a kilowatt-hour would be 11,100 cents, or $111—which is more than a thousand times the average rate paid for central station electricity. Applying the same scheme of careful calculation to the service performance of a pair of dry cells used for door-bell ringing, an even higher cost per kilowatt-hour will be obtained, for here the draft of current taken from the battery is smaller, while the extremely short periods of use result in a distressingly low "load factor."—*Electrical World.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Aberdeen Corporation electricity department held their annual "At home" on 12th inst. at the Bon-Accord Hotel. Between 50 and 60 couples were present at the supper and dance. Mr. Bell presided.

We regret to learn that MR. C. TURNBULL, M.I.E.E., borough electrical engineer of Tynemouth, underwent an operation for appendicitis last week, but we are glad to hear that he is now progressing favourably.

Tramway Officials.—The Glasgow Corporation last week, after considerable discussion, in the course of which amendments were proposed and defeated, adopted the following proposals of the Tramways Committee, with reference to the fixing of maximum and minimum salaries for heads of the tramways departments:—The scale to be:—General manager—Minimum salary per annum £1,000, maximum salary £1,400, annual increment each year until the maximum is reached £50; salary of present holder of the office, £1,100. Traffic manager—Minimum £400, maximum £700, annual increment £25; present salary, £625. Chief engineer—Minimum £400. maximum £700, annual increment £25; present salary £625. Electrical engineer—Minimum £400, maximum £700, annual increment £25; present salary, £575. Secretary and treasurer—Minimum £400, maximum £700, annual increment £25; present salary, £425.

General.—The Electrical Apparatus Co., Ltd., announce that MR. TRAVIS, of their Manchester office, has recently been appointed general sales manager. He will, in future, be stationed at their works in London, and will supervise the whole sales organisation of the company. Mr. Travis's position in Manchester has been taken by MR. H. A. BAILEY, late of the Adams Manufacturing Co. MR. H. B. ECCLES, late of the Isaria Co., has also recently joined the Electrical Apparatus Co.'s Manchester office staff as special meter salesman.

MR. A. B. RANDALL has been appointed to succeed the late Mr. A. R. Malden as secretary to the Salisbury E.L. and Supply Co., Ltd.

Obituary.—MR. J. W. WILKINS.—We regret to learn of the death, at the advanced age of 86 years, of Mr. J. W. Wilkins, who, between 60 and 70 years ago, was engaged with Mr. Fothergill Cooke in railway telegraph work. In addition to a great deal of important work of this kind, it is also stated that he was one of the earliest workers in connection with wireless telegraphy. For the last 60 years he had devoted much attention to railway and other engineering work. The *Times* says that in spite of his great age, Mr. Wilkins had for some months past been occupied in experiments on the utilisation of waste products, with a view to producing an improved material for the manufacture of electric insulators.

According to *South Africa*, news has been received of a tragic event at the Kleinfontein Mine, whereby MR. G. S. CROSS, the chief electrical engineer, lost his life. His body was found lying on the property, and his motor-car near by. Presumably Mr. Cross was returning home, and ran into a spruit on the side of the road.

MR. JAMES DUFFY, who has carried on business as an electrician in Darwen for 20 years, died last week at the age of 53 years.

The death is announced from Yokohama, Japan, of MR. R. ABBEY. The deceased, who was 72 years of age, was one of the first Englishmen who went out in 1874, at the request of the Japanese Government, to give instruction in telegraphy to the Post Office officials of that country. In the 12 years he was in the service, Mr. Abbey introduced the duplex telegraph system in Japan, and had the honour of sending the first telegram from Yokohama to Kobe when the system was inaugurated.

Wills. — It is stated that the late SIR WILLIAM PREECE, K.C.B., F.R.S., left £32,320 gross and £22,074 net personalty.

The late MR. ARTHUR CHAMBERLAIN left £143,588 gross and £125,660 net personalty.

NEW COMPANIES REGISTERED.

Newcastle-upon-Tyne Motor Co., Ltd. (132,723).—Registered December 11th, by Waterlow & Sons, Ltd., London Wall, E.C. Capital, £60,000 in £1 shares. Objects: To take over that part of the business of Sir Wm. Angus, Sanderson & Co., Ltd., which relates to the manufacture and sale of the "Newcastle-upon-Tyne" or "N.U.T." motor cycle, and to adopt agreements (1) with the said vendor company, T. Sanderson and F. H. Sanderson; (2) between Edison & Swan United Electric Light Co., Ltd., and T. Sanderson; and (3) with H. Mason. The signatories (with one share each) are:—G. A. France, M.P., Newbiggen Hall, near Newcastle-on-Tyne; T. Sanderson, St. Thomas Street, Newcastle-on-Tyne, director of Sir Wm. Angus, Sanderson & Co., Ltd.; F. H. Sanderson, St. Thomas Street, Newcastle-on-Tyne, director of Sir Wm. Angus, Sanderson & Co., Ltd.; G. F. Tweedy, Jesmond Park East, Newcastle-on-Tyne, engineer; R. Doxford, Grindon Close, Sunderland, shipbuilder; H. Mason, Burn Villas, Spital Tongues, Newcastle-on-Tyne, motor cycle engineer; W. S. Burton, Pilgrim House, Newcastle-on-Tyne, solicitor. Minimum cash subscription, 25,000 shares. The first directors (to number not less than five or more than seven) are G. A. France, M.P., T. Sanderson, F. H. Sanderson, G. F. Tweedy, R. Doxford and H. Mason; qualification (after statutory meeting), £1,000; remuneration, £50 each per annum (chairman, £100) and a percentage of the profits. Secretary, J. Hamilton; solicitors, Watson, Burton & Corder, Pilgrim Street, Newcastle-on-Tyne. Registered office, St. Thomas Street, Newcastle-on-Tyne.

Sun Power Co., Ltd. (132,640).—Registered December 8th, by Woodhouse & Davidson, 10-11, Lime Street, E.C. Capital, £600,000 in £1 shares (282,464 6 per cent. cumulative participating preference). Objects, to acquire any inventions relating to the utilisation of solar heat and apparatus connected therewith, and particularly the rights for the Eastern Hemisphere in certain inventions of Frank Shuman, of Philadelphia, U.S.A., and to adopt an agreement with the Sun Power Co. (Eastern Hemisphere), Ltd. The subscribers (with one share each) are:—Segar R. Bastard, The Friars, Chigwell Road, Essex, solicitor; A. J. King, Elleray, Windermere, bleacher and finisher; G. G. Denton, The Grange, Littlemore, Oxford, late Governor of Gambia; F. S. Gandy, 13, Defoe Road, Stoke Newington, N., accountant; W. S. Last, 111, North Hill, Highgate, company registrar; L. C. Beckwith, 382, Brixton Road, S.W., clerk; A. J. Culley, 68, Arthur Road, Brixton, S.W., secretary. Minimum cash subscription, seven shares. The first directors (to be not less than three or more than eleven), are Segar R. Bastard, A. J. King and G. G. Denton; qualification, one share; remuneration, £50 each per annum (chairman, £150; vice-chairman, £100), and a percentage of the profits. Registered office, Friars House, New Broad Street, E.C.

British Arc Welding Co. (Bristol Channel), Ltd. (132,707).—This company was registered on December 11th, with a capital of £20,000 in £1 shares, to take over a process for electrical welding under a grant or licence proposed to be given by the British Arc Welding Co., Ltd. The subscribers are:—F. Shearman, Bute Docks, Cardiff, engineer, 200 shares; J. Elliott, Bute Docks, Cardiff, engineer, 200 shares; R. S. Kennedy, 41, Howett Road, Belsize Park, N.W., engineer, 200 shares; A. J. Marquand, 2, Dock Chambers, Cardiff, engineer, 200 shares; W. E. Howlett, Tydvil Place, Roath Park, Cardiff, secretary, 100 shares; C. Jones, Trydraw Road, Roath Park, Cardiff, engineer, 100 shares; F. E. Lewis, 39, Stanwell Road, Penarth, company secretary, 200 shares. Minimum cash subscription 2,000 shares. The directors are to number not less than two or more than six. The British Arc Welding Co., Ltd, and John Shearman & Co., Ltd., may each nominate one director; qualification, £200. Secretary, F. E. Lewis. Registered office: 2, Dock Chambers, Cardiff.

W. S. Jeal & Co., Ltd. (132,643).—This company was registered on December 8th, with a capital of £550, in 500 preference shares of £1 each, and 1,000 ordinary shares of 1s. each, to carry on the business of electrical engineers, designers and manufacturers of, agents for and dealers in motor-cars, motor-cycles and accessories, electrical storage batteries and apparatus, &c., and to adopt an agreement with W. S. Jeal. The subscribers (with one preference share each) are:—C. N. Murphy, Mindaroo, Garrads Road, Streatham, S.W., merchant; F. Hill, 7, Braxted Park, Streatham, S.W., builder; J. E. M. Tyler, 3, Braxted Park, Streatham, S.W., builder; W. S. Jeal, 17, Chryssell Road, North Brixton, S.W., electrical engineer. Private company. The number of directors is not to be less than three or more than five; the first are C. N. Murphy, F. Hill, J. E. M. Tyler and W. S. Jeal; qualification £10. Registered office, 17, Chryssell Road, North Brixton, S.W.

Ledbury Electric Supply Co., Ltd. (132,276).—This company was registered on November 20th, with a capital of £4,000 in 300 cumulative preference shares of £5 each, 1,000 preferred ordinary shares of £1 each, and 1,500 ordinary shares of £1 each, to carry on the business indicated by the title. The subscribers (with one share each) are:—J. H. Edwards, 127, Victoria Street, Bristol, electrical engineer; Seymour Williams, 38, Parliament Street, S.W., solicitor. Private company. The number of directors is not to be more than six; the subscribers are to appoint the first; qualification, 50 shares. Registered office, 127, Victoria Street, Bristol.

Magnetos, Ltd. (132,721).—This company was registered on December 11th, with a capital of £1,000 in £1 shares, to carry on the business of magneto experts, electrical and mechanical engineers, &c. The subscribers (with one share each) are:—C. Godfree, 45, Broad Street, W.C., electrical engineer; R. P. Glanville, 9, Gray's Inn Square, W.C., managing clerk. Private company. The number of directors is not to be less than two or more than five; the first are C. Godfree and R. P. Glanville. Registered office, 45, Broad Street, Bloomsbury, W.C.

Railway Appliances Co., Ltd. (132,816).—This company was registered on December 16th, with a capital of £1,000 in £1 shares, to carry on the business of agents for, manufacturers, installers and users of, and dealers in appliances and mechanical and engineering devices for use upon railways, apparatus and appliances used in connection therewith, and with electricity and compressed air, &c., and to adopt an agreement with J. P. O'Donnell. The subscribers (with one share each) are:—F. E. Jones, Eden Lodge, Beckenham, solicitor; J. Groom, Palace Chambers, Westminster, secretary. Private company. The number of directors is not to be less than two or more than seven; the first are F. E. Jones and J. Groom; qualification, £1; remuneration, £50 each per annum. Registered office, Palace Chambers, 9, Bridge Street, Westminster.

OUTDOOR AIR-BREAK SWITCHGEAR.

By W. A. COATES, A.M.I.E.E.

Within the past few years great changes have been made in standard switchgear practice, and probably the most radical change of all has been the introduction of air-break switchgear for outdoor service.

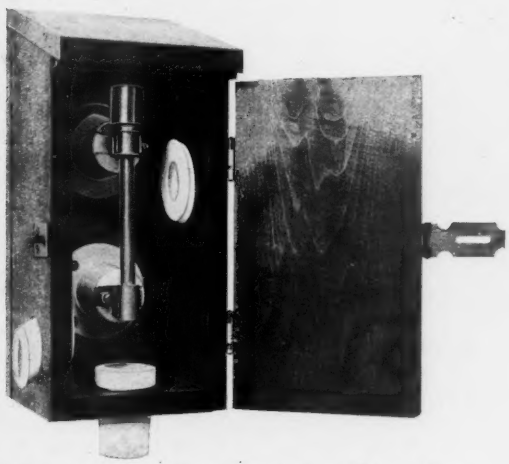
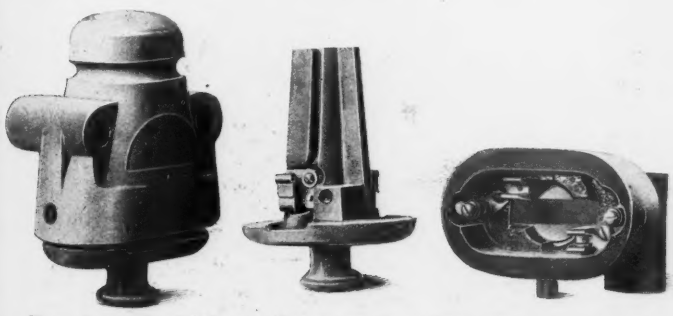


Fig. 1.—6,600-volt Fuse Enclosed in Wooden Box.

This apparatus has yet to make its appearance in England, but that it is well out of the experimental stage in America will be clear, when it is stated that air-break outdoor



Figs. 2 and 3.—3,300-volt Porcelain Plug-Type Fuse, Closed, and Taken Apart to Show Construction.

switches are now in use on systems right up to 150,000 volts and of large capacity.

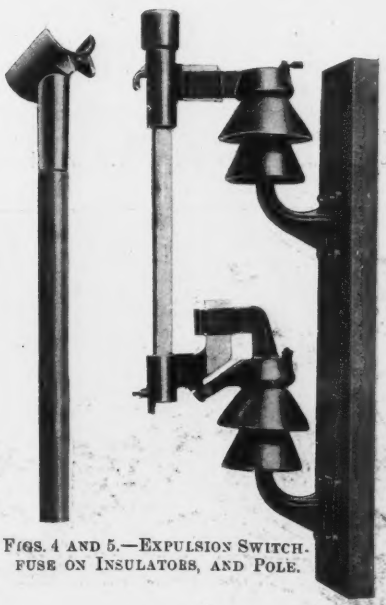
As is probably well known, power and lighting distribution in America is usually carried out with overhead feeders, and the first application of outdoor switch apparatus was to the protection of the step-down transformers, which, for capacities up to 50 K.V.A., are usually suspended from the pole cross-arms by hanger irons.

For small transformers the only protection deemed necessary (and, indeed, commercially feasible) is to have a primary fuse, and in its elementary state an indoor type of fuse was enclosed in a suitable wooden box, which could be mounted on the cross-arms with the transformers (see fig. 1). Although quite a workable proposition, such an arrangement is clearly open to improvement, and nowadays it is customary to use either a porcelain plug-fuse (figs. 2 and 3) for small capacities, or for larger transformer circuits an expulsion fuse on outdoor insulators, so arranged as to serve as a link switch (fig. 5).

The former type is so designed as to keep the live contacts properly shrouded, and the fuse is easily renewable. It can be made so cheaply that it does not become a matter of importance if the whole thing is burst by lightning troubles, as is frequently the case. This type of fuse is capable of carrying a normal load up to 30 amperes at 3,300 volts, and is by far the most popular form at present used.

The link fuse is intended to be handled by means of a pole shod with a special device to carry the fuse tube (fig. 4).

As a general thing, such devices as these are only used with transformers up to about 50-K.V.A. capacity, above



Figs. 4 and 5.—Expulsion Switch-fuse on Insulators, and Pole.

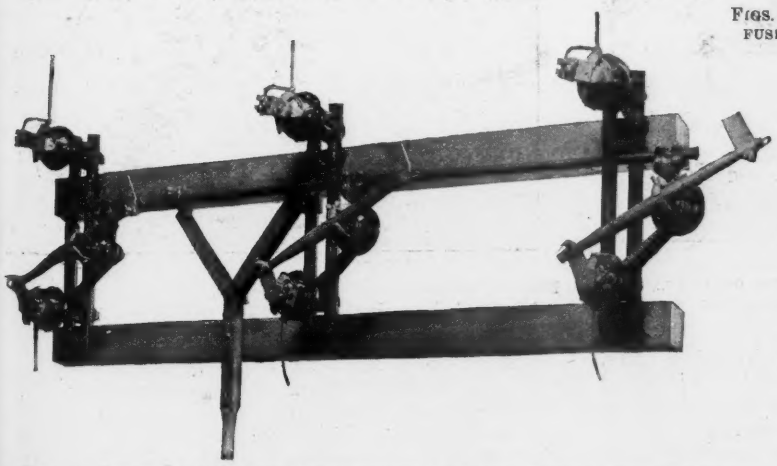


Fig. 6.—Three-Pole Remote-Mechanically Operated Switch Fuse of Medium Capacity for Mounting on Cross-Arm.

which limit it is usually permissible to spend a little more money on elaborating the switchgear.

Moreover, the weight of a 50-K.V.A. transformer is just about the maximum which can conveniently be suspended from the cross-arms by hanger irons, especially when a single-pole construction is used.

Above 50 K.V.A. it is more usual to use two or more poles, suitably braced and provided with a special bracket or platform to carry the transformer. Such construction necessarily provides greater space for the accommodation of the switchgear, and more elaborate equipment is, consequently, practicable. Fig. 6 shows a simple form of three-pole switch fuse with link operation. By this means the H.T. apparatus can be located high on the pole, well out of harm's way

and the operating lever located at the ground level, so that the circuit can be isolated without the lineman having to climb the pole. A padlock is, of course, provided to prevent interference by unauthorised persons. In this particular design the link is of wood, through the centre of which the fuse wire is passed. By this means the "expulsion" effect is still retained, while the wood tube makes a sound mechanical job.

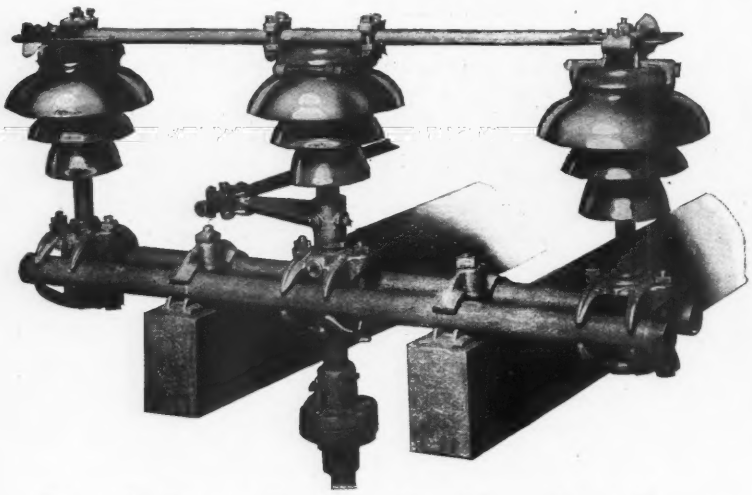


Fig. 7.—One Pole of a Three-Phase "Baum" Swivel Contact Switch.

This type of fuse has actually been built up to 22,000 volts, with a contact spacing of 16 in. While this is really sufficient to allow safe handling when renewing a fuse wire, yet it is more usual on the higher voltages to use separate switch and fuse units.

Fig. 7 shows one pole of a somewhat ingenious switch designed for use in this manner. The two contact blades are so mounted as to swivel with relation to the main contact cross-arm, and, consequently, as the switch opens, the contact blades are first wrenched round in the jaws, and thus break any ice which has frozen on to the contacts.

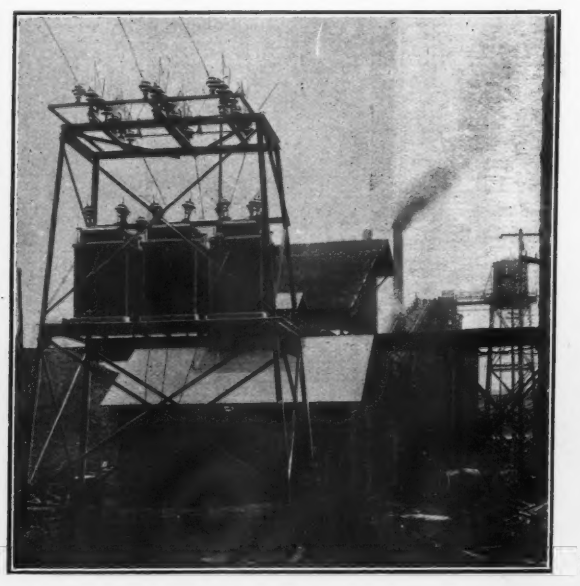


Fig. 8.—33,000-volt Outdoor Sub-Station on a Colliery Plant. The small shed contains the secondary switchgear.

In Great Britain such precautions are, perhaps, unnecessary, but in America, where the winter temperature may drop to 60° below zero F., and is subject to very severe fluctuations, ice trouble is a very real factor to be considered.

Experience shows that a wooden pole construction with a high transformer platform is not as stable as might be desired, and in exposed positions it is especially noticeable that the poles soon work loose in the ground, no matter how carefully the soil has been tamped around them.

This has led to the development of outdoor sub-stations mounted on light steel towers, which lend themselves much better to stiff mechanical construction, and are at the same time capable of being shipped in parts, and easily and quickly assembled in the field.

In figs. 8, 9 and 12 are shown three sub-stations of this type, designed and built by the Transmission Engineering Co., who have probably done more towards the development of the cheap outdoor sub-station than any other firm.

It will be noted that in all cases the line wires can be dead-ended on the switch insulators, which, together with the steel structure, are made extra stiff for this purpose so as to avoid the necessity for using additional strain towers on the line.

The particular sub-stations illustrated are in service on 33,000-volt systems, and similar apparatus has been made for all pressures from 6,600 up to 66,000 volts.

The switching apparatus on all these towers is of the design patented by Mr. A. W. Burke, a consulting engineer of Pittsburg. The incoming line is first brought to a three-pole horn-type switch, thence to a triangular choke coil and horn gap, and finally through a horn-type open fuse to the transformers which are located on a platform immediately below the switchgear.

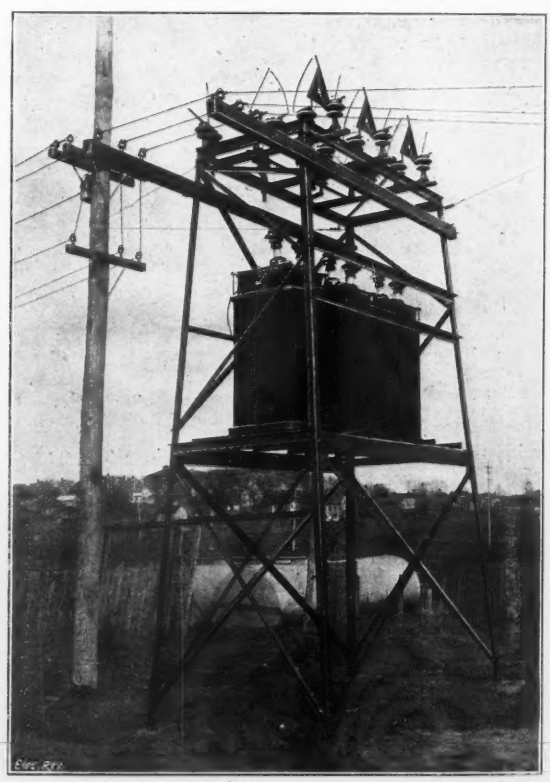


Fig 9.—Complete 33,000-volt Outdoor Sub-Station, showing "Burke" Horn Gaps and Choke Coils, and Line Pole.

The details of the switch are well shown in fig. 11, which shows the switch in a half-open position. The moving portion is carried on two insulators mounted on a common swivel pin, which moves in a brass bearing bush. The moving horn is connected to the contact blade after the manner of the flicker blade on a conventional knife switch, and consequently the chief current-carrying parts are well separated before any arc is drawn across the horns.

There is a widespread idea that rupturing an A.C. system in air must inevitably give rise to surges far more violent

than would be the case if oil switches were used. In fact, this would not appear to be the case. In fig. 10 we reproduce an oscillograph record taken across a "Burke" horn-

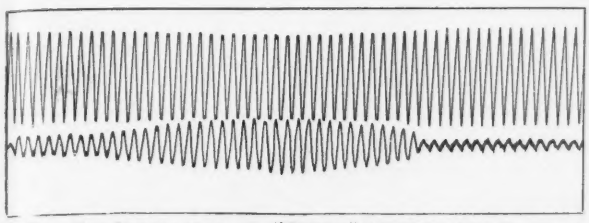


Fig. 10.—Oscillogram of "Burke" Switch opening on a 33,000-volt System with Maximum Load of 1,000 kw. passing. Upper Curve, Voltage; Lower Curve, Current.

type switch when rupturing 1,000 kw., at 33,000 volts, 60 cycles, and from this it is clear that the effect on the voltage wave is extremely slight, although the switch occupied practically one second in opening. It will be noticed that the arc "hung on" for some time after it had been drawn out to so great a length as to choke the current down to a small value. It is generally found that the arc on a horn gap "hangs on" from one to two seconds. This same "Burke" switch was subsequently tested on short-circuit, and successfully ruptured a load of 8,000 kw., which is a far greater figure than is ever likely to occur on consumers' premises.

On the system of the Sierra and San Francisco Power Co. it is even stated that the kick due to opening air-break switches on their 105,000-volt lines, is scarcely noticeable, whereas when oil switches are operated in like positions the kick is so pronounced as to cause arresters to spill over and to show a 25 per cent. variation on a graphic recording voltmeter. Unfortunately, however, the writer has not been able to secure any oscillograph records supporting these statements.

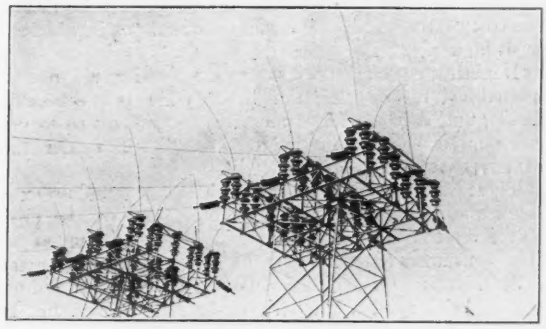


Fig. 13.—Two Three-Pole 150,000-volt Horn Switches; Southern Sierras System.

Fig. 11.—One Pole of a "Burke" Horn-Type Switch.

Fig. 14.—"Burke" Choke Coil, Horn Gap Arrester and Horn-Type Fuse.

The Burke lightning arrester, choke coil and horn fuse are shown in detail in fig. 14. It will be noticed that one side of the arrester horn is actually part of the choke coil, and as the coil is angular there will be maximum tendency to spill over just at the lower corner in the triangle.

It is claimed that due to this construction the accurate setting of the gap on low voltages is no longer of primary importance, as for the same spill-over voltage, the gap is some 50 per cent. greater than is the case with a simple horn.

The designer further claims that with dynamic current flowing exceeding 25 amperes the resulting magnetic field in the horn is so great as materially to assist in rupturing the arc, and he even goes so far as to advocate operating with no series resistance in the ground circuit.

Sub-stations such as we have described can be built for little more than half the cost of the usual form of station. We tabulate below some approximate figures based on pole-supported transformers, protected on the primary with switch fuse, choke coil and horn lightning arrester.

Approximate Net Cost per kw.

	Line voltage.		
kw.	13,200.	22,000.	33,000.
75	11s.	13s.	16s.
90	10s.	11s.	13s.
120	7s. 6d.	10s.	11s.
150	6s.	7s. 6d.	10s.
300	4s.	5s.	6s.

The steel tower type of sub-station is of necessity more expensive than those tabulated

Fig. 12.—33,000-volt Outdoor Sub-Station, Showing Secondary Strain Insulators and Switch-Operating Lever.

above, but even in this case the cost is only increased by some 2s. 6d. per KW.

It should be pointed out that in making these estimates average American prices have been taken, and in England the cost of the wood pole structure would possibly be somewhat higher.

Doubtless equipments just as illustrated would not find unqualified favour with the Home Office or the Board of Trade, but, at the same time, it is not difficult to conceive a few minor changes in design which would render them sufficiently safe for English conditions.

These high-voltage outdoor equipments are finding extensive favour in America, as they enable supply to be profitably given to small villages, individual farmers, mines and other consumers situated along the route of main feeder lines.

Such small loads would not be profitable if the ordinary type of brick sub-station with oil-break switches, &c., had to be provided.

Farmers are probably the most important class served in this way, and although at first one is apt to regard this business as mostly small lighting, yet experience goes to show that once the farmer has realised the possibilities of the electric motor, he quickly enlarges his demand.

In statistics taken by five large power companies, it was found that their farm load was over 66 per cent. power; and as the principal demand is during the day, such business is eminently useful from the load factor point of view.

Although extremely high voltages are never likely to be employed in Great Britain, yet an article such as this would be incomplete without reference to the remarkable equipments recently put into operation on their 150,000-volt lines by the Southern Sierras Power Co.

In figs. 13, 15, 16 and 17 are shown various views of sub-stations on this system. Power is transmitted from Bishop Creek to San Bernardino, a distance of some 238 miles, the generating plant being of 36,000-KW. capacity.

It is now generally conceded that on high-voltage systems it is advisable to conduct all switching operations on the L.T. side of step-up transformers, thus avoiding the risk of damage to insulation due to surges. At the same time, to deal with emergency conditions, it was deemed desirable on this system to use switches which could safely be operated on load if necessary.

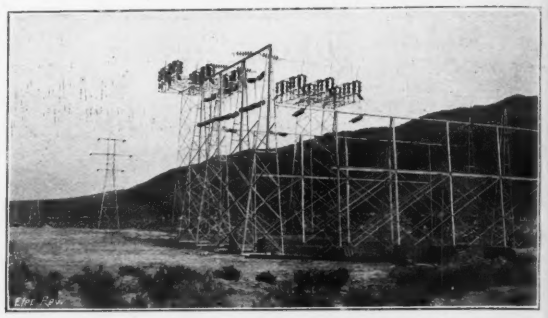


FIG. 17.—CONTROL STATION NEAR BISHOP, CALIFORNIA, SHOWING TWO DOUBLE-BREAK 150,000-VOLT THREE-POLE PNEUMATICALLY OPERATED SYNCHRONISING BOWIE CIRCUIT-BREAKERS; SOUTHERN SIERRAS POWER CO.

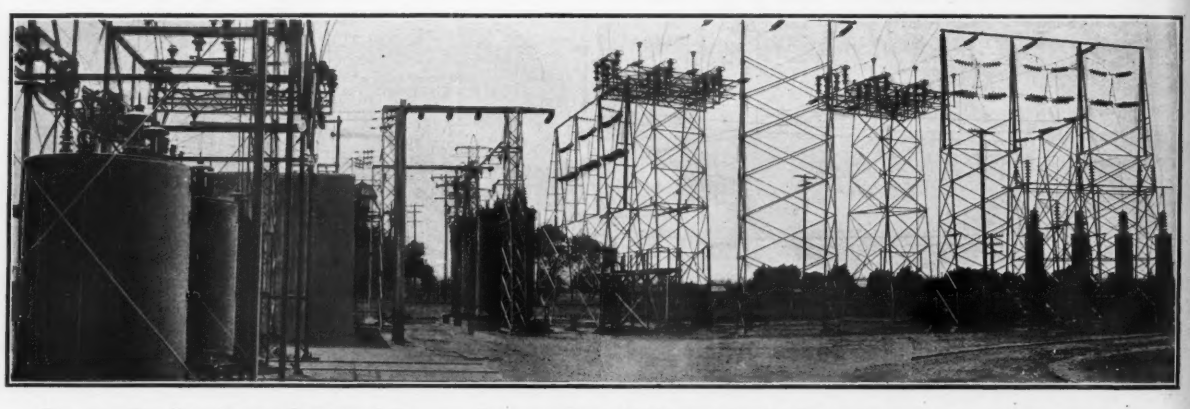
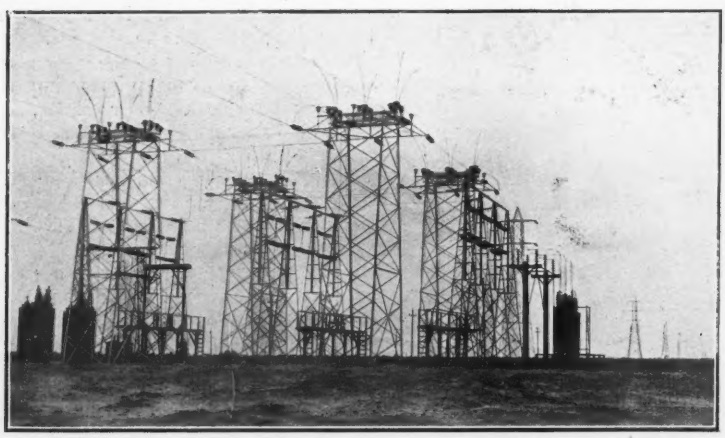


FIG. 15.—SAN BERNARDINO RECEIVING STATION, SHOWING TWO 150,000-VOLT SINGLE-BREAK ELECTRICALLY OPERATED BOWIE CIRCUIT-BREAKERS. OUTDOOR SUB-STATION OF 12,000 K.V.A. CAPACITY.



Each circuit has two Type K three-pole, 60,000 volt manually operated Bowie circuit-breakers, and cross-over switch for interconnection.

FIG. 16.—SWITCHING STATION FOR TWO CIRCUITS; SOUTHERN SIERRAS POWER CO.

Each set of switches consists of two breaks in series, and has knife blades 3 ft. long, pivoted at one end and rising in opening, thus transferring the arc to the horns. The latter are located at both ends of each blade, and are of galvanised iron tube, tapering from 1 in. diameter at the bottom towards the top.

Although no oscillograph records have yet been taken, it is stated that the switches have already been frequently operated without causing the least trouble in operation.

Up to the present in England we have only seen the oil-break form of weather-proof switchgear, and that but rarely, but the writer is of opinion that, by adopting some such radical departure from accepted practice as has been indicated above, much load, at present deemed unprofitable, could be connected up with advantage. Although such action necessarily implies overhead feeders, yet in the sparsely populated districts these should not be objectionable, and, in fact, we already have the example of several power companies, such as the Clyde Valley and Yorkshire Electrical Power systems, which distribute by overhead feeders quite satisfactorily.

The writer wishes to acknowledge assistance in preparing this article, and in providing illustrations, from the Bowie Switch Co., the Pacific Electrical Manufacturing Co., the Transmission Engineering Co. and the Westinghouse Electric and Manufacturing Co.

"ZIG-ZAG" WINDING DIAGRAMS.

By HUMPHRY MacCALLUM, B.Sc., A.M.Inst.C.E.

A very large number of "series" or "wave" wound direct-current armatures are in use nowadays, but there is reason to believe that this type of winding is not always thoroughly understood. It has been the writer's experience, in fact, that the subject is one with which the average man has a certain amount of difficulty, and reference to the text-books, as a rule, does not give much help, mainly for the reason that the essential matter is so frequently "swamped" by much that is out of date, and of little or no practical value.

The usual method of approaching the subject is by means of the circular winding diagram in which all the conductors are set out and numbered in such a way as to suggest, more or less completely, the actual arrangement upon the armature. Such diagrams are drawn for purposes of demonstration with a number of conductors very much smaller than would be used in practice, in order that the circuits may be more easily traced, and though by this means the general principle of wave winding is very clearly shown, these abbreviated diagrams are somewhat difficult to reconcile with practice, and it is probable that one or perhaps two rounds of the diagram would fulfil the purpose equally well. Apart from the important question of available space, the full circular diagram corresponding to a normal modern machine would be too complicated for the man of average patience, owing to the large number of conductors included therein.

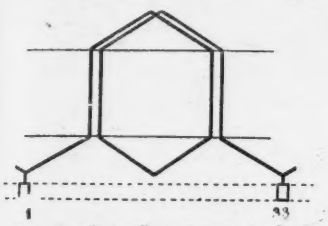


Fig. 1.—Coil Consisting of One Section of Two Turns.

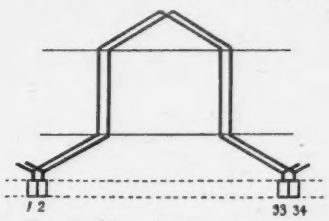


Fig. 2.—Coil Consisting of Two Sections of One Turn Each.

In actual practice, however, it is not necessary to consider the individual conductors or to number them individually, or in groups, since each section of the winding may be regarded as belonging to one commutator plate, and the commutator plates only need be numbered. This mode of procedure may be made use of in the diagrammatic representation of armature windings, and a further and greater simplification is brought about if the sections are

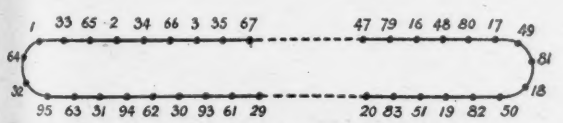
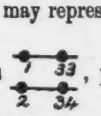


Fig. 3.—Part of a Plain Diagram of Connections for a Two-Circuit Wave Winding.

represented, as in ordinary diagrams of connections, by lines which do not necessarily bear any resemblance to the actual armature coils. For example, we may represent the section fig. 1 thus

, or fig. 2 thus 

, putting numbered dots for commutator plates, and if any simple two-circuit wave winding be taken and set out in this way, a closed loop of lines and dots, as in fig. 3, will be obtained.

Now, although it is helpful to look at any given winding from this point of view, the setting-out of the numbers first hand requires a thorough knowledge of the principle of the winding. The loop may be "zig-zagged," however, in such a way that the commutator plates come together in numerical order, and the whole then forms a new type of diagram which is easy to set out, has the advantage of being easily followed, and which, with slight modifications, is applicable to all wave windings.

As an illustration, fig. 4 is an ordinary circular diagram for a six-pole, two-circuit wave winding, having the impracticably small number of 28 conductors, or groups of conductors, arranged in 14 sections. Fig. 5 is the corresponding "zig-zag" diagram. The comparative simplicity of the latter is evident, and as the addition of any number of sections does not complicate, but merely lengthens the diagram, it is clear that the representation of practical windings, having a large number of conductors, presents no difficulty. For example, fig. 6 is the armature winding of an existing 440-volt, 200-kw. six-pole d.c. machine. The corresponding circular diagram very closely printed would cover two full pages of the Review. The index figure at the left-hand end of the above diagram forms a convenient means of showing that the number of turns per section is in this case one only. Many modern windings are built up of sections, each of which consists of one turn, *i.e.*, two conductors per section, but in small machines of normal speed and voltage, it is economical to use more than one turn per section, and for such work this has become the usual practice. Where there are two turns per section, the index figure will resemble fig. 1, with three turns per section the index figure will have three turns, and so forth.

The windings so far considered are "right-handed"* six-pole windings, and the corresponding "zig-zags" are built up of a series of vees, thus , each of which represents one "round" of the armature. In a four-pole diagram the vees would have only two dots thus, and in an eight-pole four dots thus , or in general, since in going once round the armature $p/2$ commutator plates are touched upon, there are $p/2$ dots on each vee (p = number of poles).

Figs. 7 and 8 are the "left-hand" diagrams corresponding to figs. 4 and 5, and it will be seen that whereas

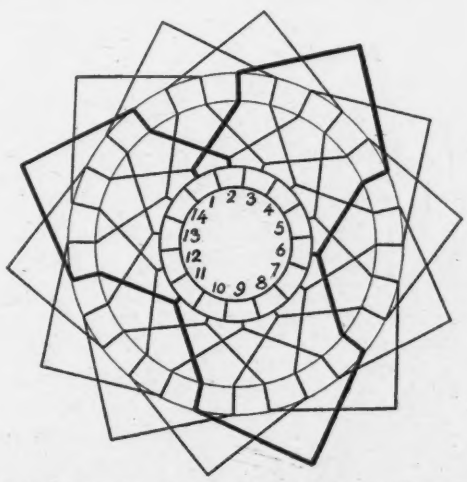


Fig. 4.—Circular Diagram for Right-Handed or Progressive Six-Pole Two-Circuit Wave Winding having 28 Conductors only.

the former is composed of a series of complete vees, in the latter the first and last vees have been mutilated by the removal of the end sections. The system of numbering also is different in either case, but all right-hand windings, and all left-hand windings respectively, are numbered in the same way, and in every case the number of dots n, in the

* For definition of "right-handed" winding see fig. 13 at end of article, or more fully by reference to article by the present writer in the Electrical Review of September 19th, 1913, page 477.

second row from the top of the diagram, is equal to the winding step at the commutator.

With the above "zig-zag" arrangement the total number

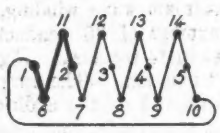


Fig. 5.—Zig-Zag Diagram Corresponding to Fig. 4.

of dots or commutator plates K is obviously equal to the number of rows multiplied by the number in a row *plus* one, if there are complete vees only, or *minus* one if the end vees are incomplete. There are $p/2$ rows, so that we have—

$K = n\,p/2 - 1$ for the right-hand or progressive windings, and $K = n\,p/2 + 1$ for the left-hand or retrogressive windings.

The above are the conditions for re-entrancy in two-circuit wave windings.

Multiple circuit (series-parallel) wave windings, or double, treble, &c. (independent series) wave windings, are but little used, but it may be of interest to examine them in terms of the "zig-zag" diagrams. Such windings must agree with the formulæ—

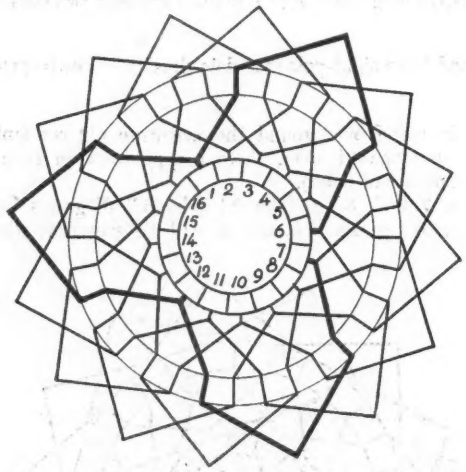


Fig. 7.—Circular Diagram for Left-handed or Retrogressive Six-Pole Two-Circuit Wave Winding having 32 Conductors only.

$K = n\,p/2 - c/2$ for the right-hand or progressive windings, $K = n\,p/2 + c/2$ for the left-hand or retrogressive windings, where c is the (even) number of circuits required.

The winding will be an independent series ($c/2$ separate

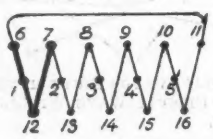


Fig. 8.—Zig-Zag Diagram Corresponding to Fig. 7.

windings) or a series-parallel according as n *is* or is *not* a multiple of $c/2$. Figs. 9, 10, 11 and 12 will serve to illustrate the point.

The total number of active conductors required in any winding is, of course, a matter of speed, magnetic flux and E.M.F., and the number of sections, and therefore the number of commutator plates K for a given number of conductors depends upon the permissible number of conductors per section, a value which is usually fixed on a "reactance voltage" basis, as suggested by Hobart. The value of K being known, a few minutes will suffice for the drawing of a diagram in accordance with the following rules, which will give correct coupling, right or left-handed as the case may be :—

1. Commutator plates are represented by numbered dots.

2. Sections of winding between commutator plates are represented by lines (curved or straight), and the number of turns in a section is shown by the index figure at the side of the diagram.

3. A right-hand or progressive winding is one in which a right-handed or C.C.E. direction of rotation gives positive brushes opposite the N poles, and in this hand of winding the ends of a round cross one another.

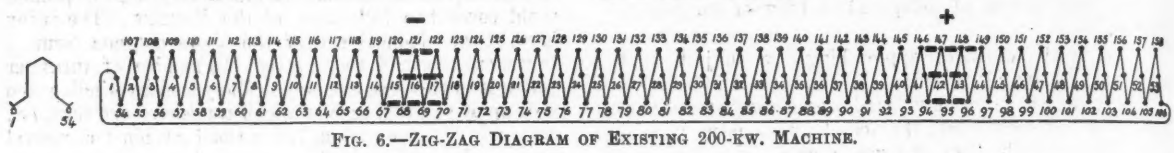


Fig. 6.—Zig-Zag Diagram of Existing 200-kw. Machine.

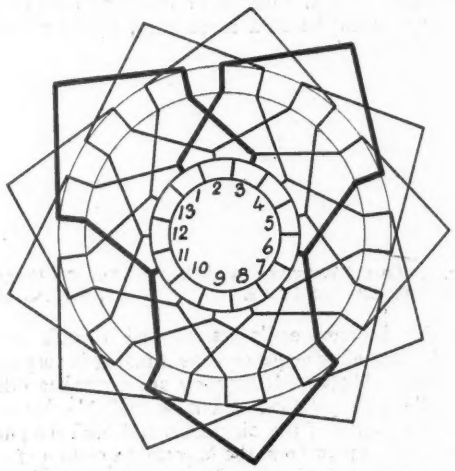


Fig. 9.—Circular Diagram for Right-handed or Progressive Six-Pole Series-Parallel Winding. $c = 4$; $n = 5$.

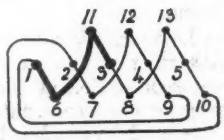


Fig. 10.—Zig-Zag Diagram Corresponding to Fig. 9.

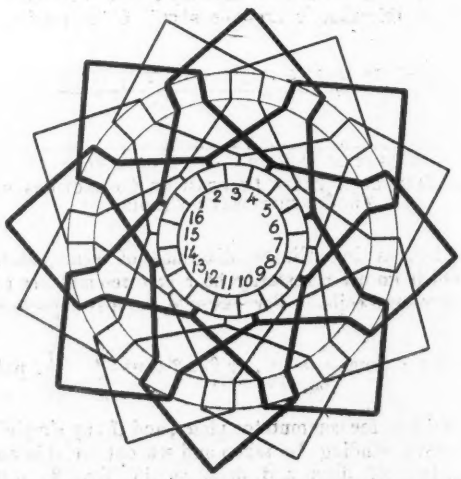


Fig. 11.—Circular Diagram for Right-handed or Progressive Six-Pole Double Winding. $c = 4$; $n = 6$.

4. Left-handed "zig-zag" diagrams consist of a series of complete vees. In right-handed diagrams the first and the last vees are minus one section. In all cases the right-hand limb of a vee is devoid of dots.

5. The number of rows in the diagram is equal to half the number of poles of the machine.

6. The numbering is from left to right, and commences in the second row from the top. The first step, *i.e.*, from 1 to $(n + 1)$, is in the left-hand limb of the first vee, and upwards if possible.

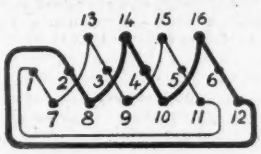
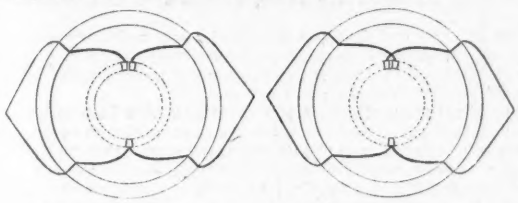


FIG. 12.—ZIG-ZAG WINDING CORRESPONDING TO FIG. 11.

7. The commutator winding step n is in all cases equal to the number of dots in the second row.

8. In a simple series (two-circuit) winding n may have any value, but in multiple-circuit series windings if n is made a multiple of $c/2$, $c/2$ separate windings will be formed,



Left-hand or Retrogressive Right-hand or Progressive.

FIG. 13.—ONE ROUND OF A 4-POLE SERIES WINDING.

It may be pointed out that brushes are shown on the "zig-zag" diagrams by a heavy black line joining neighbouring commutator part dots, as at + and — (fig. 6). There being six poles in this case, but only two circuits, it is possible of course to collect the current at two brush sets only. In other words, if one set can carry the whole current, two positive and two negative sets can be removed without affecting the output of the machine, as can be clearly seen by reference to the figure.

Mistakes in coupling, which usually lead to somewhat puzzling results, are easily followed with the help of the appropriate zig-zag, which may be drawn out in a moment on a scrap of paper when and where the occasion arises.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Edison & Swan United Electric Light Co., Ltd. (18,984).—Return dated November 25th, 1913. Capital, £888,071 in 150,000 "A" and 26 436 "B" shares of £5 each, and 23,564 "B" shares of 5s. each. 99,261 "A," 17,139 £5 "B" and 23,564 5s. "B" shares taken up. 10s. per share called up on 89,261 "A," £5 per share considered as paid on 17,139 "A," 5s. on 23,564 "B," £2 10s. on 89,261 "A" and £3 on 10,000 "A." Mortgages and charges: £449,474.

Keighley Electrical Engineering Co., Ltd. (44,893).—Return dated September 24th, 1913. Capital, £10,000 in £1 shares (3,000 pref.). 4,200 ord. and 1,800 pref. shares taken up. £1 per share called up on 2,588 ord. and 1,400 pref. £1 per share considered as paid on 1,612 pref. and 400 ord. Mortgages and charges: £5,000.

Electro-Metals, Ltd. (110,432).—Return dated July 7th, 1913 (filed November 11th). Capital, £30,000 in 4,000 pref. shares of £5 each and £10,000 ord. of £1. 102 pref. and 10,000 ord. shares taken up. £1 per share called up on 102 pref. £1 per share considered as paid on 10,000 ord. Mortgages and charges: Nil.

Cleveland and Durham Electric Light and Power Co., Ltd. (89,589).—Return dated November 3rd, 1913. Capital, £700,000 in £1 shares (350,000 preference), 333,705 preference and 157,600 ordinary shares taken up; £1 per share called up on 331,935 preference and 79,068 ordinary; £80,302 considered as paid on 1,770 preference and 78,532 ordinary. Mortgages and charges: £495,000 (including £25,000 collateral security).

Church Stretton Electric Supply Co., Ltd. (80,857).—Return dated August 11th, 1913. Capital, £10,000 in £1 shares; 8,154 shares taken up; £1 per share called up on 154; £1 per share considered as paid on 8,000. Mortgages and charges: £5,000 first mortgage debentures and £1,075 mortgage.

Rhondda Tramways, Co., Ltd.—A memorandum of satisfaction to the extent of £400 on November 28th, 1913, of charges dated March 24th, 1911, and November 13th, 1912, securing £240,000, has been filed.

Drake & Gorham, Ltd. (70,275).—Return dated October 30th, 1913. Capital, £125,000 in £1 shares. 125,000 shares taken up. £1 per share called up on 85,000. £1 per share considered as paid on 40,000. Mortgages and charges: Nil.

Cape Electric Tramways, Ltd. (54,636).—Return dated November 19th, 1913. Capital, £500,000 in £1 shares. 491,222 shares taken up. £1 per share called up on 91,222. £1 per share considered as paid on 400,000. Mortgages and charges: £440,300.

Woking Electric Supply Co., Ltd.—Charge on certain property, in Woking dated December 2nd, 1913, to secure all moneys due, or to become due, from the company, to Barclay & Co., Ltd., 54, Lombard Street, E.C.

Javal Patents, Ltd.—Issue on December 3rd, 1913, of £200, part of a series of which particulars have already been filed.

CITY NOTES.

Costa Rica Electric Light and Traction Co., Ltd.

THE annual meeting was held on Monday, at Dashwood House, Old Broad Street, E.C., Mr. Frederick Davies presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELEC. REV., page 1012), said the past year had been an uneventful and at the same time a very satisfactory one. There had been an increase in the net earnings at Costa Rica, they having amounted to £23,875, as compared with £22,033 last year, which was in itself a considerable increase over the previous year. The net surplus profit, after paying all expenses in London and debenture interest, amounted to £7,000, against £5,700 last year, which was again an increase over 1911, when the net surplus was £3,600. It was proposed to put the whole of the net surplus to the credit of the discount and commission on debenture issues account, which would thereby be reduced to a matter of £7,000, so that another year of similar progress would see the extinction of that account. The business of the company, as well as the profits, progressed satisfactorily. The number of lamps installed showed an increase of 10 per cent. in the year, which was again an increase of 18 per cent. over the previous year, and the motor supply showed an increase of 43 per cent. over last year, which was an increase of 55 per cent. over 1911. The power plant at El Brasil, which was inaugurated in December, 1911, had worked throughout the year without a hitch, and it was contemplated to effect an immediate installation of the fourth unit which would enable them to utilise to the full the second pipe line at the earliest possible moment. The machinery was now on order, and they were expecting immediate delivery. The cost which would amount to about £4,000 would be defrayed out of the revenue for the current year. There was ahead of them a certain amount of expenditure, and no doubt some of the shareholders would be a little surprised, in view of the favourable figures which they were able to present, at receiving an offer of debentures at the low price of 65. As they were aware, they had incurred obligation by way of loan from a financial house, amounting to £13,400, which, during the year under review, had been increased to £14,277. It was anticipated that that loan might have run on until other matters had absorbed it, and therefore no definite date was fixed for repayment; and the best terms they were able to arrange in order to induce the lenders to allow the loan to remain on hand until next March, was to deposit the unissued balance of their old debentures with them, and authorise them to sell sufficient of the debentures to repay themselves, and to call them at the price of 60. That option extended over the whole of their unissued 5 per cent. debentures. They were very loath to give such an option, but they had no choice in the matter. The option expired at the end of this year, except as regarded sufficient debentures to cover any unpaid loan which might exist at that time, and he supposed it was obvious that the offer to the debenture-holders at 65 was the result. As far as the directors were concerned, they were only anxious to make it clear to the shareholders that the action of offering them at such a low price was forced upon them. They had in the future to look forward to certain expenditure in the way of additions and reparations to their plant. It would be necessary before very long to contemplate the re-modelling of the overhead mains, and there were various other matters which would entail a total expenditure of some £10,000 or £12,000. None of those things, however, required immediate attention, and their idea was to discharge them as they became necessary out of the revenue for the year. The balance of profit this year—£7,337, was a very handsome one—and if the business progressed during the remainder of the year as it had done since the accounts were closed, they thought there would be a still better result at the end of the current year. They should have a surplus of probably £10,000 instead of £7,000, but, on the other hand, they must not lose sight of the fact that at present they were enjoying a suspension of the sinking fund for the debentures, which was to be re-instated in June next. At the same time they had the competition of the plant which formerly belonged to Mr. Mendiola Bozza, and which had now passed into the hands of Mr. Alvarado. That undertaking during the past year had developed a very large water power some short distance above the company's, and it remained to be seen to what purpose that new power was to be devoted. They did not look upon the situation with any trepidation, but at the same time they faced the fact that their sole competitor had thought it worth while to develop very large power, and it might result in their having to reduce their rates in order to meet competition. The situation did not fill them with any alarm, but they hoped to be able to deal with any necessity that might arise.

MR. C. A. VANISTTART seconded the motion.

Replying to questions, the CHAIRMAN said that the option to which he had referred expired at the end of this month, and so far it had not been exercised to any considerable extent. As he had said, the terms were very onerous to the company, but there was no help for it, and he could only hope that the option would not be exercised.

The report was adopted.

Prospectus.—*Calgary Power Co.*—Last week £156,400 5 per cent. first mortgage bonds were offered for sale at £90 per cent.

Shawinigan Water and Power Co.—The directors have declared a dividend at the rate of 6 per cent. per annum on the common shares for the quarter ending 31st inst

Crompton & Co., Ltd.

A MEETING of the debenture-holders was held on Thursday, December 18th, at the offices, Salisbury House, E.C., Mr. C. F. Tufnell presiding.

The CHAIRMAN said the meeting had been called because Mr. Ivor Bevan, the surviving trustee, had expressed the wish that they should invite the debenture-holders' attendance in order to give them some further information as to the company's prospects, and also to give them an opportunity of asking any questions. Those present were doubtless aware that the company had been through rather troublous times, and whereas profits were made in past years, in the last two or three balance-sheets a loss had been shown. The outlook for business was better, but it became necessary that the company should put their balance-sheet in order, and get further moneys for the purpose of working capital which was urgently needed. A reconstruction scheme was put before the shareholders and successfully carried through last June. That scheme brought into the company some £50,000 odd of additional working capital. The result to the company arising out of the reorganisation and reconstruction and from the issue of additional capital had, he was glad to say, been very beneficial and more than justified what the directors told the shareholders. At the time of the reconstruction in June the accounts for the year ending March 31st were not completed, but the result of the trading for that year was a profit sufficient to pay the debenture interest, directors' fees, the full depreciation which it had been their custom to provide for, and to leave a balance over. A very satisfactory profit had been earned for the half-year ended September 30th last, and the directors confidently expected that the result of the year's working to March 31st next would justify their recommending to the shareholders the payment of a dividend upon the new capital. It might interest them to know that the orders received since April 1st showed a gratifying increase on the previous year, and although there were signs that the boom in the trade of the country had reached its limit, and that therefore there might be some diminution in trade activity in the coming year, they anticipated that the changes they had effected, and the economies in manufacture which their new arrangements provided, would more than compensate for any possible decrease due to the falling-off in trade. Turning to the question of the position of the debenture-holders, the original trust deed and each debenture contained a provision to the effect that the debentures were not repayable in the event of a winding-up for the purpose of reconstruction. The debentures were due for repayment in 1920, and what the directors would have liked would have been to suggest to the debenture-holders that they should exchange their debentures for debentures in the new company, possibly extending the date for repayment, but there was a difficulty in the way. The very general three-fourths majority clause was not in the trust deed. Consequently, in order to carry through an exchange of that sort they would require the individual consent of every debenture-holder, and it was found in actual practice impossible to do that. In the circumstances the only course open to them was to follow the letter of the trust deed and to keep the existing debentures in force, taking whatever steps were necessary to protect the interests of the shareholders. The freehold land and premises had been transferred to the new company, subject, of course, to the charge in favour of the debenture-holders, and the new company had given a charge on all its property, present and future, including any uncalled capital, in favour of the trustee for the debenture-holders. Of course they would at once recognise that the position of the debenture-holders was thereby very considerably improved. That was shown in the market price of the debentures, which had gone up something like 18 points since the reconstruction. Like most of the debenture-holders, he (the chairman) had received a circular letter from the Quoted Investment Trust, in which it was suggested that the company was trying to ride rough-shod over the debenture-holders. There was no foundation whatever for that suggestion; on the contrary, their contention was that throughout the interests of the debenture-holders had been most carefully guarded. More than that, it was the debenture-holders who would benefit most by the reconstruction, and if they wanted evidence of that they had only to look at the market price of the debentures and the way they had risen in price since the reconstruction. The suggestion that when the debentures became due for repayment in 1920 the holders had no security that the company would not make some effort to postpone the date of payment seemed to him to be merely childish. The company had no option in the matter. They were bound to repay in 1920, or at any rate to give the debenture-holders the option of taking cash or exchanging for new debentures. If the Quoted Investment Trust, or any other debenture-holder, chose to apply to the Court, of course the company could not prevent it, but he could only tell them that the directors had obtained the best legal advice that they could possibly get in regard to the procedure which had been adopted throughout, and they had no doubt whatever as to what the result of any application to the Court would be.

MR. GILBERT PLAYER inquired whether the assets had been handed over to the new company.

MR. UNDERWOOD asked whether it was intended to appoint another trustee.

MR. WESTON, a director of the Quoted Investment Trust, in the course of some lengthy remarks, said that while they had no desire to injure Crompton & Co., they intended that the rights of the debenture-holders should not be interfered with. The debenture-holders had lent the company £100,000 under terms and conditions as to interest and repayment which were set out in the trust deed. Their legal advisers had taken counsel's opinion as to what the trust deed meant, and he advised them that the holders of the debentures were entitled to receive back the sum of money which they had lent to the company, and to receive it now. Seeing that the price of the debentures in the market was in the neighbourhood of 70, it was perfectly obvious that it must be to the interests of the holders, who were not shareholders, to be repaid now, rather than allow their debt to run on for a series of years. The chairman had told them that the company had taken legal advice, and had obtained a contrary opinion. That being the case, the only thing to do was to obtain the opinion of a judge, and that would be done.

MR. IVOR BEVAN, the surviving trustee, said that another trustee would be appointed. He could not see what advantage it would be to the debenture-holders to be repaid immediately. If a man had got a good debenture, and he was perfectly sure that his security was of value, he did not see any advantage in his wanting to be rid of it.

MR. WESTON said that that was just the point; the debenture-holders, as far as he was aware, were not satisfied with their security.

MR. PLAYER said that, as a shareholder and a debenture-holder, he agreed with Mr. Weston that the debentures should be paid off. He could not see that the trustees had any power whatever to hand the debenture-holders over to a new company.

The CHAIRMAN said that the assets had been handed over to the new company. With regard to the gentlemen who held debentures in connection with the Quoted Investment Trust, he thought they were to be congratulated on their investment. £650 of their holding of £750 was acquired by them apparently in August or September last, some months after the reconstruction was carried through, and the average price paid by them for their holding was £58. Not content, however, with 40 per cent. profit in a few months, those people had approached the liquidator with a proposal that they should be bought out at par or a trifle under. The liquidator quite properly, in his opinion, refused.

MR. A. P. MEEBS said that, as representing some old debenture-holders, he would like to know whether they were fully protected. He presumed the trustee would see that a clause was put in the deed that the debentures must be repaid in 1920.

MR. IVOR BEVAN: They are repayable then, and I cannot alter it.

MR. STUDHOLME then proposed a resolution approving of the scheme, and expressing the opinion that, in the circumstances, no action by the trustee was called for.

MR. ANDREWS seconded this proposition, which was carried with two dissentients.

Douglas Southern Electric Tramways Co. — The directors report, according to the *Financier*, that the total traffic receipts for the season were £6,492, against £5,204 last season, an increase of £1,288, due to the fine and seasonable summer, which attracted a large increase of visitors to the Isle of Man. The passengers carried were 265,763, against 212 528 last year, an increase of 53,235. The tolls payable to the Douglas Head Marine Drive, Ltd., amounted to £1,082 and a commission of £324. After deducting these amounts and adding receipts from discounts and transfers, there is a total of £5,096 net receipts, against £4,082 for the previous year. The net profit is £2,435, against £1,733, and makes, with £177 brought forward, a disposable balance of £2,612. The directors recommend the full dividend on the 7 per cent. non-cumulative preference, and a dividend of 3¼ per cent. on the ordinary shares, absorbing £2,321, carrying forward £291.

Continental.—FRANCE.—The report of the *Société Industrielle d'Energie Electrique*, of Paris, for the year ending June 30th last, shows a net profit of £38,200, as compared with £39,780 in the preceding 12 months. A dividend of 6 per cent. is being declared, and, after making allowance for depreciation, &c., £9,054 is carried forward.

GERMANY.—A company has lately been formed in Strasburg, with a capital of £50,000, and the title Die Kraftversorgung Gesellschaft Lothringen, to undertake the supply of electrical energy for power purposes throughout Lorraine.

BELGIUM.—La Société d'Electricité de Seraing proposes to increase its capital to the extent of £120,000, with the view of extending its electricity supply system. The company is already supplying current to no less than 22 communes, and is in negotiation with a number of others.

Stock Exchange Notices.—Applications have been made to allow the following securities to be quoted in the Official List:—

Cuban Telephone Co.—$2,000,000 preferred stock in shares of $100 each in lieu of the scrip.

Metropolitan Railway Co.—Further issue of £504,216 3½ per cent. "A" debenture stock.

Official Announcements re Companies.—The following companies will be struck off the Register at the expiration of three months, unless cause is shown to the contrary:—

Anglo-Russian Refuse Destructor Co.
Electricity Generating Co.
Ferabin Lamp and Electrical Accessories.

W. & T. Avery, Ltd.—The directors have declared an interim dividend for the six months ended September 30th last at the rate of 5 per cent. per annum on the ordinary shares.

British Columbia Electric Railway Co., Ltd.

Mr. G. P. Norton presided on Friday at the Great Eastern Hotel, E.C., over the seventeenth ordinary general meeting of this company, in the absence of Mr. R. M. Horne-Payne through illness.

Mr. T. Blundell Brown read the speech which had been prepared by Mr. Horne-Payne, in which he said the board regretted the delay which had taken place in submitting the annual statement and in holding the meeting, but year by year the work of preparing and auditing the accounts and of analysing, considering and adjusting them grew heavier and heavier, and this year, in spite of every effort, it had been impossible to submit them at an earlier date. They also regretted that the report was not of a more satisfactory nature. He knew that a number of shareholders had been somewhat alarmed at the decrease which was occurring in their earnings. He thought they were needlessly alarmed. Unfortunately he could not tell them that this period of hard times was over. He did not expect to see any improvement until the end of the Canadian winter, that was to say, until April or May next, but he did think they would then see a gradual general improvement in commercial conditions, which would be reflected in the earnings, and that there would be a complete return of prosperity and progress in 1915. He gave that merely as his personal opinion, but his considered opinion for what it was worth. If he was right it meant that next year's report might be even less satisfactory than the present one, but that they would have good results to show in 1915. He believed that this period of halt would in the end prove good for the country and for the company, and that it would result in cheaper conditions of living and a very sound economic position in British Columbia. Meanwhile, they must exercise patience and be thankful that owing to the prudent policy of re-investing portions of their profits in the past they were now able to face one or two slack years with equanimity. They had, perhaps, been a little spoilt with too much prosperity. They had enjoyed increase upon increase in earnings month by month for 16 years, and had become so accustomed to this happy state of affairs that they were inclined to be unduly alarmed by a comparatively unimportant decrease. They could not have all sunshine and no shadow. There was nothing in the situation to justify the very heavy fall in the price of the securities and stocks, which had been brought about by the selling of stockholders whose fears had been aroused by the general fall in Canadian and all other securities and by the decrease in the earnings, and especially by the newspaper reports of an agitation in British Columbia to induce Parliament to enact certain measures restricting their rights to fix fares and charges. Again, he believed he could safely say that these fears were needless. Their rights were regulated by the conditions contained in Acts of Parliament and municipal agreements which constituted a solemn and frequently reaffirmed bargain made by the people of British Columbia to induce them to invest their money in the country. They could only be changed by an Act of Parliament, which, whether it directly restricted their rights to make certain maximum charges, or empowered a public commission to do so, would constitute a complete breach of faith. They rested confidently in the hands of a responsible British Government and a responsible British Parliament who were not in the least likely to lend themselves to such a dishonest proceeding, which would destroy the good name of the province throughout the financial world and stop the raising of capital for any purpose in British Columbia for years to come. As might be seen from the attitude of the leading British Columbia newspapers, there was no body of responsible public opinion behind this agitation, which was the work of certain noisy and ill-informed individuals who, by correspondence in the Press, and sometimes in public speeches, gave expression to statements which were misleading and generally absolutely false, and so made it difficult to raise capital for expenditure in British Columbia. He mentioned this in order to allay the fears that some of the shareholders might entertain on the subject, and to point out to the public in British Columbia that these irresponsible utterances did serious harm to the province, and particularly to working men. If the introduction of capital for new works and enterprises ceased, employment for the working classes necessarily diminished. The publicity given to this agitation had had its effect in curtailing the inflow of capital into the province, and there was in consequence less demand for labour. The agitation referred to arose out of a slight rise in certain fares, which was absolutely necessary in order to maintain the financial stability of the company, and was mainly supported by fatuous statements to the effect that the company had been coining untold wealth. Their critics never tired of stating that they were paying 8 per cent. upon their share capital, but they omitted to say that they were only paying 8 per cent. on the par value of their deferred share capital, and that the deferred share capital had been subscribed at a large premium, and amounted to little more than one-seventh part of their investment, and that the deferred shareholders had taken all the risks of a pioneer enterprise, from which the people of British Columbia had benefited enormously. The money actually expended on the enterprise amounted to $45,000,000, on which the interest and dividends paid out last year were equal to less than 4¼ per cent. They had from time to time voluntarily reduced their charges, and should be only too pleased to do so again when the profits justified it. They were at present charging a very great deal less than the maximum they were entitled to charge, and which, in some cases, they could charge with reason. For instance, they should, owing to the high price of coal, have been entirely justified in increasing their price for gas throughout this year, but they had not done so, as they hoped the unfortunate strike of the coal miners would end, and they had tried to avoid increasing the expenses of their customers during the prevailing bad times, but, if the strike continued, they might be forced to adopt this course. On the subject of further capital expenditure, although the directors were asking for power to create additional share capital, they had no intention of issuing it at present, nor did they expect to issue it during the next year, but it was necessary that they should have power to issue additional shares as and when that course became desirable. Meanwhile, he could give the shareholders the most definite assurance that capital expenditure had for some time past been cut down to the very lowest possible amount, and that they would continue to limit it to absolute necessities until they received greater encouragement, and the pressure of genuine demand for their various services proved that it was necessary, and would be remunerative. He must not be understood to suggest that any of their capital expenditure in the past had been unwise or unnecessary. In looking back over the record of the past 10 years, he saw very little expenditure that had not been entirely justified, and that would not prove remunerative. Their great water-power installations at Lake Buntzen and Lake Coquitlam and at Jordan River, on which large sums of money had been spent, were practically completed. They were assets of great and permanent value, and would, they anticipated, meet any increase in the power requirements of the company for some years. They had no new enterprises or railway extensions of an extensive character in contemplation. He had received a number of letters from shareholders urging that they should not invest any further money at all in British Columbia. This, of course, was neither desirable in the interests of the company, nor possible. New householders in their districts were entitled to have their lighting and heating services extended to them. New industries were entitled to be supplied with power, and the travelling public were entitled to have their increasing needs provided for. All this required a certain amount of capital expenditure, but, as they had already said, they would limit their expenditure to what was absolutely necessary to carry on their business efficiently. In conclusion, he said again that he looked to the future of the company with confidence. The future of the British Columbia Electric Railway was bound up with, and inseparable from, the prosperity of British Columbia, and of the future of British Columbia with all its mineral, agricultural and forest wealth, and its rapidly increasing shipping trade, there could be no doubt. He would urge them in their own interests not to allow their confidence in the future of British Columbia or Canada, or in their Canadian investments, to be in the least degree shaken by present discouraging circumstances, which were almost exclusively due to disturbed financial conditions. Canada had this year again amply justified every claim that had been made for her. Her production of wealth from field crops and farm produce, and from mineral and other natural resources, had been greater than ever before, and the only trouble had been of a monetary nature, a recurrence of which it was hoped would be prevented in the future.

The Chairman, in moving the adoption of the report, said there was a slight error in the figures. The miles of single track in operation during 1913 should have been 334·02 miles instead of 357·82.

Mr. E. L. Evan-Thomas seconded the motion.

A Lady Shareholder asked if the board thought it wise to increase the capital in the present state of affairs.

Mr. Dyer Edwards suggested that the board might add several local advisers. The enterprise was growing by leaps and bounds, and required an enormous amount of attention. They had plenty of officers, but, as a large shareholder, he would like to see an advisory committee.

Mr. Davenport said he had a large stake in the company, and he had every confidence in it. One benefit in the depreciation of their capital had been pointed out to him—that they would have to pay less in death duty. One matter he would point out was that when the company issued the prospectus of the Victoria Power Co., they gave no hint of the falling off in the company's receipts. With regard to the suggested issue of further capital, they had received the directors' assurance that it was not intended to issue it, and that being so, he did not see why they should not wait until the next year before bringing forward the resolution.

Mr. C. W. Butler asked the board for particulars as to their purchase of land in the Saanich Peninsula.

The Chairman said that Mr. Horne-Payne had informed them emphatically that it was not the present intention to issue further capital, but they were taking the opportunity of getting the power, because they must have some capital powers in hand. He thought they might rest content with the assurance of the chairman. They did have several local advisers for a number of years, but the fact that this had been discontinued was sufficient answer that it did not serve a practical purpose. At the time the Victoria Power Co. prospectus was issued there was no information of a definite falling off of receipts. The land in the Saanich Peninsula was acquired under very favourable terms, and could now be disposed of with advantage if necessary.

The report was adopted, and, on the motion of Mr. T. Blundell Brown, a hearty vote of thanks was accorded to the staff.

The Chairman then proposed that the capital of the company be increased to £5,000,000 by the creation of 400,000 new shares of £1 each, and this was seconded by Mr. E. M. Harvey.

On a show of hands, the resolution was declared carried, but Mr. Davenport said he would demand a poll. Several shareholders appealed to Mr. Davenport to have confidence in the board, which had served them so well in the past, and Mr. Davenport agreed to withdraw his demand, and said he meant to cast no reflection whatever on the board.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

Major Leonard Darwin presided, on December 18th, at the offices, 106, Cannon Street, E.C., over the fiftieth ordinary general meeting of the above company.

The Chairman, in moving the adoption of the report (see Electrical Review, page 969), said it was with very great regret that the board had to announce the retirement, on account of ill-health, of Mr. R. K. Gray, so long the managing director of the company, a post to which he succeeded in 1901 on the retirement of his father. Mr. Gray devoted himself unremittingly and unsparingly to the service of the company for the whole of the 44 years he was connected with it, and the board would feel his absence keenly, not only on account of his business ability, but also because of the esteem which his character inspired in all directions in a remarkable degree. They were glad to say, however, that Mr. Gray had consented to become an extraordinary director, thus enabling them to consult him on the many matters concerning which his advice would be of value. The board had appointed Mr. C. H. Gray and Mr. W. E. Gray as managing directors, both of whom had spent their business lives in the service of the company. They had, moreover, elected to their board Mr. Nigel Hanbury, of the firm of Wood, Field & Hanbury, whose family had been considerable shareholders in the company for over 33 years. The general business of the company had been well maintained, and the results obtained at Silvertown have been satisfactory, both as regarded outputs and profits. With reference to their special lines, the reputation of the Palmer tire, which they alone manufactured, stood, they believed, deservedly high, though they were constantly engaged in efforts to improve their patterns and to extend their markets. In view of these satisfactory conditions affecting the year's trading profits, the directors had hoped throughout the year for a better result than that actually presented. During the period under review the price of rubber kept falling slowly, and this fact somewhat adversely affected the valuation of the stock in hand at the end of the year, as it had to be written down to the value calculated on the price of rubber of the day. Their French factory had not responded as quickly as was anticipated to the reorganisation which had there been adopted. This matter was engaging the serious attention of the board, and it was hoped that the improvements in progress would be materially accelerated. The same condition of things might be said to apply in a lesser degree to some of the foreign agencies. In the National Insurance they had a new item of expenditure, amounting in the past year to £2,340, and the rates this year had reached the figure of 11s. 2d., as compared with 9s. four years ago. Such an increase of rates, if it continued for long, would drive all industry out of West Ham. But though the manufacturer in these days had a good many difficulties to contend with, it was true that they could not assert that they had got more than their proportionate share to face. The obstacles that did stand in their way they would endeavour to overcome to the best of their ability.

Lieut.-Col. A. Weston Jarvis seconded the motion.

Before putting the motion, the Chairman said that that was the jubilee meeting of the company, and he was glad it was a happier meeting than the one two years ago. He hoped the improvement they had had would continue in the future. He never liked to prophesy unless he was certain, and in the case of a manufacturing business, it was impossible to be certain ; but he did look with hopefulness and assurance to the continuance of the progress made.

The report was adopted, and the retiring directors and auditors were re-elected.

Mr. F. H. Sulley proposed a vote of thanks to the directors and staff, and Mr. Atkinson, in seconding, asked the chairman if he was hopeful of keeping up the present dividend, or did he hope they would go on to the large dividends that they used to have.

The motion was carried, and the Chairman, in reply, said that if he replied to the question put, he would get into the region of prophesy, which he had already said he would not indulge in. All he would say was that he was very hopeful of the future. The whole staff was energetic and loyal, and worked in the interests of the company.

German Electrical Companies.

The *A.E.G.-Lahmeyer Werke of Frankfort-on-Maine*, after placing £2,360 to depreciation in 1912-13 as compared with £2,340 in 1911-12, record net profits of £34,300 as against £31,900. The directors recommend the payment of a dividend of 6 per cent on share capital of £500,000, being the same rate as in 1911-12.

The *Deutsche Elektrizitats Werke, Garbe, Lahmeyer and Co., of Aix-la-Chapelle* realised net profits of £32,000 in 1912-13 as compared with £40,000 in the preceding year; and a dividend at the rate of 5 per cent. has been declared, being the same as in 1911-12. The sum of £10,000 has been passed to the account of the dividend equalisation fund as against £15,000 in the previous year, and the carry forward amounts to £14,000 as contrasted with £12,000 in 1911-12.

The Report of the *Telephonfabrik A.G. vorm. J. Berliner of Hanover* states the turnover substantially increased in 1912-13 and the Company had and has an abundance of government orders on hand. The branches were employed and the participation in the foreign business continued to yield satisfactory profits. After allocating £10,000 to depreciation as compared with £12,000 in 1911-12 and making provision for reserve fund, the accounts exhibit net profits of £40,000 as against £24,000. It is proposed to distribute 12 per cent., this comparing with 8 per cent. in 1911-12.

The *Kabelwerk Rheydt*, which has declared a dividend of 12 per cent. for 1912-13 as against 8 per cent. in 1911-12, reports that the value of the turnover exceeded £1,000,000. The constant concern of the directors was to perfect the plant, and the copper rolling mill dealt with 10,000 tons of copper and was extended so as to cope with profitable orders. As a result of further combination of the cable-making firms in other branches of manufacture than hitherto, it was possible to obtain adequate prices in accordance with the situation of the market. The gross profits reached £84,000 as compared with £60,000 in 1911-12, the dividend absorbing £30,000 on a share capital of £250,000 and the sum of £15,000 being carried forward.

The report of the *Elektrische Licht und Kraftanlagen A.G. of Berlin*, which is an investment company having a scope of activity in regard to undertakings in various countries, states that the circumstances prevailing during the year caused the company to exercise increased reserve in relation to new transactions involving considerable capital, and business was therefore substantially limited to the advancement of existing enterprises. The gross profits in 1912-13 amounted to £218,000 as compared with £208,000 in 1911-12. After defraying general expenses, taxes, interest on loans, etc., the accounts indicate net profits and balance forward of £137,000 as contrasted with £136,000. The directors propose a dividend of 7½ per cent. on share capital of £1,500,000, being the same rate as in the preceding year.

The *Gesellschaft fur Elektrizitats Anlagen of Berlin*, which belongs to the group of the before-mentioned Elektrische Licht und Kraftanlagen, either owns or is financially interested in various supply works and tramways. According to the directors' report for 1912-13, the surpluses realised by the company's own undertakings experienced a further increase over the preceding year. The accounts indicate gross profits of £61,000, as compared with £61,000, and after providing for general expenses, interest on loan capital of £300,000, and placing £4,000 to the renewal and redemption fund, as compared with £61,000, and after providing for general expenses, interest on loan capital of £300,000, and placing £4,000 to the renewal and redemption fund as contrasted with £3,250 in 1911-12, there remain net profits and balance forward of £44,000 as against £32,000. It is intended to pay 8 per cent. on share capital of £500,000, being the same rate as in each of the two previous years on less capital.

The directors of the *Bayerische Stickstoff Werke A.G. of Munich* in their report for 1912-13 state that the year was the first in the course of which the plant was uninterruptedly in full operation, and the plant stood the test notwithstanding the fluctuations in the water supply of the Alz. The situation of the market for the principal produce—cyanamide—was favourable, and the whole of the output was disposed of through the Sales Association for Nitrogen Fertilisers. In the case of sulphates of ammonia very satisfactory prices were realised during most of the year, business having only become more difficult towards the close. The extension of the plant was begun during the year, and would presumably be completed in the current financial year. The net profits permit of the payment of a first dividend amounting to 9 per cent. on share capital of £330,000, which is now proposed to be increased to £400,000.

THE SIEMENS-SCHUCKERT GROUP.

The financial statement of the *Siemens-Schuckert Works Co.* for the year ended on July 31st, 1913, indicates net profits of £692,000, as contrasted with £673,000 in 1911-12. It is intended to distribute among the two proprietary companies—the Siemens and Halske Co. and the Electricity Co. formerly Schuckert and Co.—a dividend at the rate of 10 per cent. as in the preceding year. The sum of £125,000 has been allotted to the reserve fund as in 1911-12, £25,000 has been placed to the contingency fund as against £17,500, and £75,000 to the payment of bonuses to officials as compared with £65,000, and £17,000 has been carried forward as contrasted with £15,000 in 1911-12.

The accounts of the *Elektrizitats Gesellschaft vorm. Schuckert of Nuremberg* show gross profits of £484,000 for 1912-13 exclusive of the balance forward amounting to £62,000, these figures comparing with £428,000 and £62,000 respectively in the previous twelve months. After meeting general expenses, interest charges, taxes, etc., and placing £142,000 to ordinary depreciation as against £130,000 and £35,000 to extraordinary depreciation, there remain net profits of £364,000 as contrasted with £352,000 in 1911-12. The sum of £5,000 has been allocated to the special reserve fund, and £16,000 has been allotted to the directors, managers and officials as their share. Out of the balance it is proposed to pay a dividend of 8 per cent. on share capital of £3,500,000, being the same rate as in the previous year; and to carry forward £63,000 as against £62,000 in 1911-12.

The accounts of the *Siemens and Halske Co.* for the year ended with July, 1913 show net profits of £625,000 as compared with £620,000 in the preceding year. It is proposed to pay a dividend of 12 per cent., being the same rate as in 1911-12; to place £100,000 to the special reserve fund as in the previous year, and £25,000 to the contingency fund as contrasted with £17,500; to apply £45,000 as in 1911-12 to the payment of bonuses to officials and workmen, and to carry forward

£60,000 as compared with £63,000. The progress of the company in the past ten years has been as follows:—

Year.	Profit.	Dividend %.	Capital.
1903-04 ...	£276,000 ...	7 ...	£2,725,000
1904-05 ...	349,000 ...	9 ...	2,725,000
1905-06 ...	398,000 ...	10 ...	2,725,000
1906-07 ...	435,000 ...	11 ...	2,725,000
1907-08 ...	484,000 ...	11 ...	2,725,000
1908-09 ...	571,000 ...	12 ...	3,150,000
1909-10 ...	575,000 ...	12 ...	3,150,000
1910-11 ...	616,000 ...	12 ...	3,150,000
1911-12 ...	620,000 ...	12 ...	3,150,000
1912-13 ...	625,000 ...	12 ...	3,150,000

CAPITAL EXPANSION IN GERMANY.

The *Elektrizitats Gesellschaft vorm. W. Lahmeyer and Co. of Frankfort-on-Main* proposes to increase the share capital from £1,250,000 to £1,500,000 for the purpose of satisfying the financial requirements of several subsidiary companies, which have arisen from the progressive development of the latter. The Zurich Bank for Electrical Enterprises, which holds £1,086,000 of the total share capital of the Lahmeyer Co., will take over the new issue and offer the shares to existing proprietors at a fixed price which has yet to be settled.

The *Siemens Elektrische Betriebe A.G. of Berlin*, which owns or leases various supply undertakings and is also financially interested in others, now intends to raise fresh capital for the development of the enterprises. At present the company has a share capital of £875,000, and loans amounting to £1,053,000, the latter being of the 4½ per cent. class. On the present occasion, however, the money market conditions have rendered it necessary for the company to have recourse to bonds bearing interest at 5 per cent. The loan is divided into two parts. The first comprises a sum of £225,000 which is to be offered in Germany, and the second the sum of £10,000,000 fcs. (£400,000) which is being placed in the Swiss market at the price 99½ per cent. and redeemable in 25 years at 103 per cent.

The *Deutsche Ueberseeische Elektrizitats Gesellschaft of Berlin*, which owns supply works at Buenos Ayres and in other South American cities, has caused some surprise in the financial world by coming forward with a new proposal to raise fresh capital so soon after the last loan issue of £1,250,000 which was made last April. Already its share capital amounts to £6,000,000, apart from loans of £5,500,000, but further money is required to repay the bank debt of £500,000 and provide for extensions at Buenos Ayres, Santiago, Valparaiso, Montevideo and Mendoza. It is now intended to create a new class of share by the emission of £1,500,000 in the form of 6 per cent. cumulative preference shares redeemable at any time at the price of 110 per cent. The company's banking syndicate has undertaken to take over the issue at par, bear the cost and stamp charges, and offer the shares for subscription at the price of 107½ per cent.

Cordoba Light, Power and Traction Co., Ltd.

The directors' report to September 30th, 1913, states that since the date of the last report, the company has acquired the outstanding shares of the Cordoba Light and Power Co., and now owns the whole of that company's share capital, together with the whole of the share capital of the Cordoba (Argentine) Electric Tramways Construction Co., Ltd. The balance of profit, after meeting all charges, is £20,926, plus £12,631 brought forward, making a total of £33,557. £10,055 of this has been absorbed by the payment of the dividend on the preference shares to 31st July, 1913, leaving a balance of £23,502. In the circumstances mentioned below the directors recommend that this sum be carried forward. Although the gross receipts have shown a satisfactory increase, the expenses of operation of both the subsidiary companies were greater than was anticipated. The receipts have also been affected by local competition, necessitating an active campaign which has already met with considerable success and will be continued unless satisfactory arrangements can be made. Some of the additional operating expenses were occasioned by a strike of tramway employees; while others, such as the removal to more convenient offices and the appointment of additional canvassers, should have a beneficial effect on future returns. A representative of Messrs. J. G. White and Co., Ltd., is now in Cordoba investigating the present methods on behalf of the Board with a view to bringing about increased efficiency and economy. The new hydraulic station of the Power Company has worked satisfactorily during the year. There is now a large balance of power available in the combined hydraulic stations of the company to meet the growth of the business. Additional boilers are being put in at the steam station as a precaution against any temporary suspension of working at the hydraulic stations due to accident or shortage of water at the San Roque Dam. The Tramways Company now has 26¾ miles of track in operation, another 2¼ miles constructed but not in operation, and a further extension of about 1½ miles is in course of construction. The debenture stock now ranks as a first charge on the properties of both the subsidiary companies, the £100,000 of 5 per cent. bonds of the Power Company having been redeemed on 1st January, 1913. In accordance with the trust deed securing the debenture stock, £5,200 has been redeemed during the year. The directors record the death, on 30th September last, of their chairman, Mr. Frame Thomson, who had been most closely associated with the company since its formation, and whose services to the company were of the greatest value. Mr. G. A. Touche, M.P., has been elected chairman.

The fifth annual meeting was held on December 7th, at Winchester House, E.C., Mr. G. A. Touche, M.P., presiding.

The Chairman, in moving the adoption of above report, after referring with regret to the untimely death of the late chairman, Mr. Frame Thomson, said that he had only consented to occupy the chair temporarily at the earnest request of his colleagues. Proceeding to review the present position, the chairman said that since the last meeting the company had acquired the outstanding shares of the Cordoba Light and Power Co. They had a concession to supply electric energy in Cordoba for a period of approximately 40 years, expiring in December, 1948. They also had a concession granted on October 11th, 1910, to construct and operate tramways in Cordoba for 75 years. The company had constructed 29 miles of track, of which 26¾ miles were already in operation, as compared with 25½ miles a year ago, and 2¼ miles were expected to be put into service in a few days. Another 1½ miles were in course of construction. The Tramway Company was authorised to supply light and power in the City of Cordoba. The capital expenditure to date of the two undertakings amounted to £1,850,430, of which £1,330,481 was in respect of the power undertaking, and £519,949 in respect of the tramway. The capital raised amounted to £1,799,800, and adding sundry creditors £27,667, and £23,501 balance on profit and loss, they got a total of £1,850,968. That practically balanced their investments in, or the indebtedness of, the local undertakings, which amounted to £1,850,430. During the year the capital expenditure had amounted to £250,896. Of this £112,800 was attributable to the Power Co., and £38,000 was for the Tramway Co. The further expenditure authorised, so far as could at present be estimated, was about £116,000, which was expected to be spread over a period of two years. The growth of capital expenditure required close supervision, and was carefully watched by the directors. Where such expenditure was not absolutely essential, he thought it would be the wish of all of them that it should be held in check until the large expenditure already incurred had become more fruitful. He must admit that the present net revenue afforded no adequate return to shareholders. Turning to the accounts for the past year, he said it would be noted that the gross receipts amounted to £79,983 as compared with £86,052 a year ago. The result therefore looked worse, but it was really better, as the previous year's receipts were not really a reflection of the underlying companies' operations, but were swelled by interest and other receipts which had not occurred this year. This year's receipts represented the net earnings of the undertakings, and comparing them with the previous year, they were about £17,000 better. They had had to contend with the tramway strike, there had been extraordinary expenditure, and they had also had to meet competition. The net revenue he admitted was disappointing and the expenses had exceeded the estimate, which was made by Mr. Frame Thomson some time ago. It had been the intention of Mr. Thomson to go out to Cordoba in order to see what economies could be effected, and the board had sent out a representative of Messrs. J. G. White and Co., who were operating the tramways, to see what could be done in that direction. They had not yet received that gentleman's report, but he had no doubt that when they did it would be satisfactory to the shareholders. The total result of the year was a revenue balance of £7,871. They had a balance of £12,630 last year, so that they were able to carry forward the substantial sum of £20,501. In all the circumstances of the case, he felt confident that the proprietors would approve the policy of the board in carrying that amount forward, much as they would have liked to have declared a dividend. A shareholder had written asking him to enlighten the meeting upon the working of the two companies—the power and the tramway—and he was able to give them the figures up to September 30th. Taking the light company first, their gross receipts for 1913 were £83,100, as against £75,300, an increase of £7,800. The expenses were £30,300, as against £35,000, a decrease of £4,700, and the net profits were £52,800, against £40,300, an increase of £12,500. The percentage of expenses to gross receipts had been 36.5, as against 45.5 last year. The company's net receipts represented at present about 4 per cent on the amount at which the power undertaking stood in the books. At regards the tramway company, the number of passengers carried was 7,755,800, against 6,804,600, an increase of nearly a million. The gross receipts were £70,900, as against £62,600, an increase of £8,300, and the expenses were £42,900, as compared with £39,100, an increase of £3,600. The net receipts were £28,000 against £23,500, an increase of £4,500, and the percentage of expenses to gross receipts was 60½, as against 62½ for the previous year. The net result of the tramway undertaking represented about 5½ per cent on the amount at which the shares stood in the balance sheet. Although the results were disappointing, when he looked back upon what had been achieved, he felt that the difficulties before them were relatively small, and that the shareholders were entitled to hope for better results in the early future.

Mr. George Kitchin seconded the motion, and the report was adopted.

STOCKS AND SHARES.

Saturday Afternoon.

The events of the past few days have certainly not been calculated to make the season any the merrier for the Stock Exchange, unless it be for those fortunate individuals who have sufficient strength of mind to remain short of shares for a length of time. Heavy falls have occurred in most Brazilian, Mexican and Canadian securities, while the shrinkage in Consols goes on with a persistence worthy of a better cause than that of playing directly into the hands of the bears.

Further consideration of the details connected with the proposed rearrangement of capital in the London electric supply companies does not flatter the idea that the scheme is likely to bring about any particular change in the prices of the shares. This, as we have said before, is so much to the good, and it is fortunate that the Stock Exchange market declined to be excited over the sensational way in which the details were at first served up. One can well understand, in fact, that the promoters of the scheme may experience more than a transient feeling of annoyance that the matter, after all a purely domestic one up to the present, should have been made the subject of journalistic fuss.

City of London shares are a trifle lower on balance, and most of the principal shares show no change at all since the beginning of the week. More effect has been wrought upon the Debenture stocks, a demand for which was a feature before the scheme was published, and which have been sought after still more keenly during the past few days. The most interesting point in the situation, as well as the most piquant, at present, is the attitude likely to be adopted by the London County Council when the County of London Bill comes before Parliament next session. The L.C.C. investigation now in progress will probably be hastened, and its report will certainly attract a good deal of attention.

Brazilian Traction shares are flat in consequence of a heavy fall in the prices of various Brazilian securities, Government, Railway and others. Fears are revived lest the difficulties connected with the slump in rubber and coffee should seriously embarrass the Brazilian Government. In addition, there are financial difficulties in Brussels, which are said to have brought about the downfall of one or two houses in that city, where, of course, Brazil Tractions and Brazil Railways are largely held. The Common fell 2 points. Manaos Tramway Debenture dropped 3. Rio Tramway bonds receded a point.

The feature in the Mexican group, so far as electrical issues are concerned, is weakness in Mexico Tramways, which have fallen from 2 to 3 points. The 6 per cent. 50-year mortgage bonds have dropped to 79½ middle. At 80 the yield is exactly 7½ per cent. on the money, but in addition, there is £3 coupon payable on January 1st, so that if the position were a little more promising, the bonds would certainly look tempting. Mexican Light and Power varieties are dullish, and almost everything connected with the country has been further depressed this week, the news being regarded as more grave than ever, and as offering small gleams of hope that the situation will right itself rapidly.

The Home Railway market made quiet headway in spite of the adverse circumstances against which it has had to contend. Metropolitans, Districts, and Underground Electrics gave way, but rallied to some extent, although the last-named, so far as the £10 shares are concerned, are ½ lower at 3⅞, the 1s. shares receding to about 8s. Metropolitans went back to 42⅞, hardening later on to 43½, and Districts are steady at 30¼. In the Home Traction group there has been little fresh movement since our last report, and this part of the market is almost stationary.

Part of the heavy fall has been recovered already in American Telephone and Telegraph Capital stock, the directors declaring the quarterly dividend at the regular rate of 8 per cent. per annum—an effective retort to the rumours that the distribution was to be reduced at once. The American Railroad market, after pronounced flatness, has rallied sharply, and most of the things affected by its sphere of influence followed suit. Telegraph and cable issues, as a whole, are quietly steady. The exception is West India and Panama Ordinary, which have dropped $\frac{3}{16}$ to 2⅜ upon two or three sellers coming into the market simultaneously. Marconis have gone back, after their recent improvement.

The manufacturing group is irregular. The feature is a rise in Brush 7 per cent. Preference shares, which has lifted the quotation to 5s. middle, while the Prior Lien Debenture stock at 75 is two points higher. Edison & Swan Debenture eased off, however, and Electric Construction shares are $\frac{1}{16}$ lower. Castner-Kellners drooped a little; but Willans & Robinson Debenture continues to advance, showing another rise of two points this week. India-Rubber shares remain weak, following up their previous fall of half-a-sovereign with another of similar amount.

The speech of Mr. Arthur Lampard at the United Serlang Company's meeting on Thursday was couched in the usual hopeful vein to which rubber shareholders have become accustomed. It had practically no effect upon the market, where share prices remained dull under the influence of rumoured increases of capital by one or two of the leading companies in the near future. The price of the raw stuff clings closely to 2s. 3d. per lb. After all the talk, correspondence, and literature which has been poured out of late on the subject of some improvement in the methods of selling rubber, it is scarcely astonishing that some people should be growing restive at the masterly inactivity displayed by those who ought to be in a position to take decided steps.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Tuesday, December 23rd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	per lb.	3d.	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£33 10	..
a Bleaching powder	,,	£6 5	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£17 10	..
a Copper Sulphate	,,	£23 10	..
a Lead, Nitrate	,,	£29 10	..
a ,, White Sugar	,,	£28	..
a ,, Peroxide	,,	£32	..
c Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a ,, Chlorate	per lb.	8½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	,,	7½d.	..
a Shellac	per cwt.	92/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	,,	£8 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5	..
a Soda, Caustic (white 70/72 %) ..	,,	£10 5	..
a ,, Chlorate	per lb.	8½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£96	..
b ,, Wire, in ton lots (1 to 14 S.W.G.)	,,	£121 6 8	..
b ,, Sheet, in ton lots ..	,,	£126	..
p Babbitt's metal ingots	,,	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7¼d.	¼d. dec.
c ,, Tube (brazed)	,,	9¼d.	..
c ,, ,, (solid drawn) ..	,,	8¼d.	¼d. dec.
c ,, Wire, basis	,,	7¾d.	¼d. dec.
c Copper Tubes (brazed)	,,	10¼d.	⅜d. dec.
c ,, ,, (solid drawn) ..	,,	10¼d.	..
g ,, Bars (best selected) ..	per ton	£82	..
g ,, Sheet	,,	£82	..
g ,, Rod	,,	£82	..
d ,, (Electrolytic) Bars ..	,,	£67	£1 dec.
d ,, ,, Sheets ..	,,	£85	£1 dec.
d ,, ,, Rods	,,	£72 10	£1 dec.
d ,, ,, H.C. Wire	per lb.	8¾d.	¼d. dec.
f Ebonite Rod	,,	4/6	..
f ,, Sheet	,,	4/-	..
n German Silver Wire	,,	1/10	..
h Gutta-percha, fine	,,	7/-	6d. dec.
h India-rubber, Para, fine	,,	8/1	¼d. inc.
f Iron Pig (Cleveland warrants) ..	per ton	50/-	5d. inc.
f ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Pig	,,	£18 5 to £18 10	dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 10	..
e Mica (in original cases) small ..	per lb.	6d. to 8s.	..
e ,, ,, ,, medium	,,	3/6 to 6/-	..
e ,, ,, ,, large ..	,,	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	,,	8/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	,,	1/1 to 1/3½	..
p ,, ,, rolled bars & rods	,,	1/0½ to 1/2	..
p ,, ,, rolled strip & sheet	,,	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	½d. dec.
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£170 10 to £171 10	£3 10 dec.
n ,, Wire, Nos. 1 to 16	per lb.	2/5	1d. dec
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£25 12 6	17/6 inc.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

The R.A.C. Trials of Electric Lighting Sets for Motor-Cars.—Early in the present year the rules and regulations with regard to a series of certified trials, extending over a distance of 2,000 miles, of dynamo-electric lighting sets were issued by the Royal Automobile Club, in connection with which the proprietors of *Country Life* offered a £50 cup, to be awarded to the entrants of the lighting set whose performance was the best. Not having heard anything as to the results of the trials, we made inquiries of the R.A.C. and find that it has never taken place, for the simple reason that no entries were received for it. In view of the increasing adoption of electric lighting on motor vehicles, and the useful information to motorists which the tests would have brought to light, it would be interesting to learn the reason for the abstention of makers of car electric lighting sets from these particular trials.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Dec. 19th.	Rise + or Fall	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	6	5†	9⅛ — 10⅛	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8⅝ — 9⅛	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10 — 10⅜	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	96 — 98	..	4 11 10
Brompton & Kensington, Ord.	5	10	9†	8⅜ — 9⅛	..	4 9 9
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8⅝	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	90 — 93	..	4 6 0
Charing Cross, West End & City	5	5	5†	4⅛ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅝ — 4⅛	..	5 9 1
Do. Do. 4 % Deb.	100	4	4	90½ — 92½	..	4 6 6
Chelsea, Ord.	5	5	4†	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	96 — 99	+1	4 11 0
City of London, Ord.	10	9	6†	16½ — 17½	— ½	5 2 10
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 3 4
Do. 4½ % Second Deb.	100	4½	4½	99 — 101	..	4 9 1
County of London, Ord.	10	6	5†	11⅞ — 12⅛	..	4 18 0
Do. 6 % Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	104½ — 105½	..	4 5 3
Do. 4½ % Second Deb.	Stock	4½	4½	98 — 101	..	4 9 1
Edmundson's, Ord.	£3	..	..	5/16 — 9/16	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3¾ — 4¼	..	7 1 2
Do. 6 % Non-Cum. Pref.	5	..	..	1⅜ — 1⅝	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	6	6	4⅜ — 4⅞	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅛ — 4⅜	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0
Hove	5	9	8†	8¾ — 9¼	..	4 17 9
Kensington & Knightsbridge, Ord.	5	8	8†	7⅞ — 8⅛	..	4 17 6
Do. 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	..	5 12 6
London Electric, Ord.	3	2½	..	1⅛ — 1⅜	..	4 12 7
Do. 6 % Pref.	5	6	6	4½ — 5½	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	+1	4 6 3
Metropolitan	5	4	4†	3¼ — 3⅜	..	5 10 4
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅜	..	4 12 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	97 — 100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	79 — 82	..	4 5 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 — 103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 10⅜	..	5 11 7
Oxford	5	7	6†	6 — 6½	..	5 7 8
St. James' and Pall Mall, Ord.	5	10	10†	8½ — 9	..	5 11 1
Do. 7 % Pref	5	7	7	6½ — 7	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	4	5½	..	2⅛ — 3⅛	..	6 15 4
Do. 5 % First Mort. Deb.	100	5	5	98 — 101	+1	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1 3/32 — 1 7/32	..	5 14 9
Do. 4½ % First Deb. Stock	100	4½	4½	93 — 96	..	4 13 9
Urban, Ord.	£3	Nil	..	5/16 — 9/16	..	..
Do. 5 % Cum Pref.	5	3	..	1/16 — 1/8	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	3⅜ — 3⅝	..	..
Westminster, Ord.	5	10	10†	8½ — 8⅔	..	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	4 13/16 — 5 1/16	+ 1/16	4 6 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6†	5⅛ — 5⅜	..	5 11 7
Calcutta, Ord.	5	8½	5†	7⅜ — 7⅝	..	5 11 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Calgary Power, 1st Mort. Bds.	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com.	$ 00	7	8	108 — 112	..	7 2 10
Do. 7 % Pref.	$100	7	7	119 — 124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	5	..	7/16 — 9/16	..	7 13 0
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	88½ — 90½	..	6 12 7
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	93 — 96	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	94½ — 96½	..	5 8 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/32 — 5/32	..	Nil
Do. 6 % Pref.	1	6	6†	31/32 — 1 3/32	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102½ —104½	..	4 15 8
Madras, Ord.	5	Nil	..	1⅛ — 1⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	68 — 73	..	7 0 10
Mexican Lt. & Power, Common	$100	4	4	43 — 47	..	8 9 6
Do. 7 % Cum. Pref.	$100	7	7	78 — 83	..	8 8 6
Do. 5 % 1st Mort. Gold Bds.	..	5	5	77 — 81	..	6 3 5
Do. 5 % 2nd Mort. Bonds	100	5	5	66 — 71	..	7 0 10
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	58 — 63	..	7 16 0
Montreal, Lt., H. and Power	$100	9	10†	216 —222	..	4 10 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	101 —106	..	5 13 2
Do. 5 % Deb. Stock	Do.	5	5	100 —102	..	4 18 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 4
Shawinigan Water, Capital	$100	5½	6†	135 —139	..	4 6 4
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105½—107½	..	4 13 0
Do. 4½ % Per. Deb.	Stock	4½	4½	96½ — 98½	..	4 11 5
Toronto Power, 4½ % Deb.	Do.	4½	4½	95 — 98	..	4 11 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	89 — 91	..	5 8 9
Victoria Falls Power, Pref.	1	6	6	⅞ — 1	..	6 17 2
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 8

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	4½	6½ — 6⅞	..	6 13 4
Do. 5 % Deb. Red.	Stock	5	5	95 — 97	..	5 3 1
American Telep. & Teleg., Cap.	$100	8	8	116 —119	+2	6 14 6
Do. Collat. Trust	$1000	4	4	88 — 91	+1	4 8 0
Anglo-American Telegraph	Stock	3	3	63 — 66	..	4 11 0
Do. 6 % Pref.	Do.	6	6	105 —106	..	5 13 9
Do. Def.	Do.	30/-	..	24⅜ — 24⅞	..	6 0 7
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	8	..	7 5/16 — 7 7/16	— 1/16	5 5 10
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	79 — 81	..	4 18 9
Cuba Telegraph	10	6	6†	8 — 9	..	6 13 4
Do. 10 % Pref.	10	10	10	14½ — 15½	..	6 9 0
Direct Spanish Telegraph, Ord.	5	4	4	8¼ — 8½	..	5 6 8
Do. 10 % Cum. Pref.	5	10	..	6¾ — 7¼	..	6 12 0
Direct United States Cable	10	4	4†	6⅛ — 6⅜	..	5 18 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	124 —127	..	5 10 3
Do. 8½ % Pref. Stock	Do.	8½	8½	75— 77	..	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	94 — 96	..	4 8 4
Eastern Extension	10	7	7	12 — 12½	..	5 12 0
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust	10	6	6†	10⅝ — 11½ xd	..	5 7 10
Do. 6 % Pref.	10	6	6	11⅞ — 12½ xd	..	4 18 0
Great Northern Telegraph	10	20	5†	30½ — 32½	..	6 2 8
Indo-European Telegraph	25	13	5†	57 — 59	..	5 10 2
Mackay Companies Common	$100	5	5	79 — 83	..	6 0 6
Do. 4 % Cum. Pref.	$100	4	4	64 — 68	..	5 17 8
Marconi's Wireless Telegraph	1	20	10†	9 5/16 — 9 7/16	— 1/16	5 16 8
Do. 7 % Cum. Partic. Pref.	1	17	..	2⅜ — 2½	— ⅛	6 3 8
Monte Video Telephone, Ord.	1	6	6	1/16 — 1/8	..	6 0 0
Do. 5 % Pref.	1	5	5	1/16 — 1/8	..	6 3 1
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	97½ — 98½	..	4 11 5
Oriental Telep. and Elec.	1	10	10†	1⅝ — 2	..	5 0 0
Do. 6 % Cum. Pref.	1	6	6	1 5/16 — 1 7/16	..	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97 — 99	..	4 1 0
Reuter's	10	10	10†	8½ — 9½	..	10 16 2
Submarine Cables Trust	Cert.	6	6	122½ —125½	..	4 15 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 11
United River Plate Telephone	5	8	6†	6⅜ — 6⅞	..	5 16 5
Do. 5 % Cum. Pref.	5	5	5	5 — 5⅛	..	4 11 0
West Coast of America	2½	2½	..	1 3/16 — 1 5/16	..	4 3 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	10	1½	1½	2⅛ — 2⅜	— 1/16	5 0 0
Do. 6 % Cum. 1st Pref.	10	6	6	9⅞ — 10⅜	..	5 17 0
Do. 6 % Cum. 2nd Pref.	10	6	6	9 — 9⅜	..	6 6 4
Do. 5 % Debs.	100	5	5	98 —100	..	5 0 0
Western Telegraph, Ltd.	10	7†	7	12⅜ — 13⅛	..	5 5 8
Do. 4 % Debs.	Stock	4	4	92 — 94	—1	4 5 0
Western Union 4½ % Fdg. Bonds	$10.0	4½	4½	92 — 95	..	4 14 9

* Unless otherwise stated, all shares are fully paid. Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Dec. 19th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	⅜ — ⅝	..	Nil
Do. 5 % Pref.	1	5	5	13/16 — 15/16	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	10½	12½	+ ½	..
Do. Do. Deferred	100	..	..	4 — 5½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	84 — 87 xd	..	6 18 0
Do. 7 % Non-Cum. Pr'f.	100	8	..	52 — 55	..	5 9 1
Do. 5 % Perp. Deb.	100	5	5	92 — 95	..	5 5 5
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 80	..	5 12 6
Central London Railway, Ord.	100	3	3	61 — 66	..	4 11 0
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	78 — 80	..	5 0 0
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	96 — 98	..	5 2 0
Do. Do. 1896	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1903	100	5	5	94 — 96	..	5 4 2
Do. 4 % Deb.	100	4	4	89 — 91	..	4 8 0
Hastings Trams, 6 % Pref.	1	6	6†	⅜ — ½	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2¼ xd	..	6 18 4
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	77 — 81	..	6 8 5
London and Suburban, Ord.	1	..	..	3/16 — 5/16	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	⅜ — ½	..	..
Do. Do. 4½ % 1st Deb.	100	4½	4½	74 — 79	..	5 14 0

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Dec. 19th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	59 — 63	..	6 7 0
Metropolitan Railway Consol.	100	1⅝	1¼†	43¼ — 43¾	..	3 14 3
Do. Surplus Lands	100	2½	2½†	58 — 60	..	4 11 8
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	..	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan District Ord.	100	Nil	..	30 — 30½	..	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	93 — 95	..	4 4 3
Do. 4½ % First Pref.	100	4½	4½	81 — 83	..	5 8 5
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	83 — 86	..	5 4 8
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	8½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	1/16 — 1/8	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	1/2 — 3/4	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	8½ — 8¾	— ⅛	Nil
Do. "A"	1/-	..	..	3/8 — 7/16	— 1/32	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	111 —113	..	5 6 2
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	6	6	88 — 89	— ½	6 14 10
Yorkshire (West Riding). Ord.	5	Nil	..	¼ — ⅜	..	Nil
Do. 6 % Pref.	5	3	4	3½ — 4	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	81 — 86	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4¼ — 4⅝	+1/16	5 11 4
Do. 2nd Pref.	5	5½	5½	4 3/16 — 4 7/16	..	6 3 11
Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 5
Do. 4½ % Deb.	100	4½	4½	97½ —99½	..	4 7 0
Do. 5 % Deb.	100	5	5	97 — 99	..	5 1 0
Auckland Trams, 5 % Deb.	100	5	5	101½—103½	..	4 16 7
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅝ — 11⅛	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	97 —100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	84½— 86½	—2	6 18 7
Brisbane Trams Invt., Ord.	5	8	8	7⅛ — 7⅞	..	5 8 8
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 —101	..	4 9 1
B. Columbia Elec. Rly., Def.	100	8	8†	110 —114	—1	7 0 4
Do. Pref. Ord.	100	6	6	102 —106	..	5 13 2
Do. 5 % Pref.	100	5	5	102 —105	..	4 15 3
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	92 — 95	..	4 9 6
Calcutta Trams, Ord.	5	7½	5†	5⅛ — 6⅜	..	5 17 8
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	95 — 98	— ½	4 11 10
Cape Electric Trams	1	5	5	2½ — 2¾	..	6 19 0
City Buenos Aires Trams (1904)	5	5†	5	5½ — 5⅝	..	4 10 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	86 — 92	..	5 8 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 96½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5% A Deb.	100	5	5	85 — 90 xd	..	5 11 1
Do. 6% B Deb.	100	8	..	10 — 20	..	Nil

La Plata Elec. Trams, Ord.	1	..	..	⅜ — ½	..	..
Do. Pref.	1	4½d.	6	1 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅛ — 1⅜	..	4 7 3
Do. 6 % Pref.	1	6	6	1 3/16 — 1 5/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4¾ — 5½	..	5 14 3
Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	81 — 84	—3	5 19 1
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	..	5 1 6
Mexico Trams Com	$100	7	7	71 — 74	—2½	9 9 2
Do. Gen. Con. 5 % Bonds	..	5	5	77 — 82	—3	6 2 0
Do. 6 % Bonds	100	6	6	78 — 81	—2½	7 8 2
Para Elec. Rlys. & Lt., Ord.	5	10	10†	5⅞ — 6⅛	..	8 0 0
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	94⅛ — 96⅛	..	5 3 8
Perth (W.A.) Elec. Tr., Ord.	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅞ — 6⅛	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	96⅜ — 98⅜	..	4 11 5
Rio de Janeiro Trams, 1st Mort. 6 % Bonds	..	5	5	99½—101½	—1	4 18 6
Do. 5 % Mort. Bonds	100	5	5	90 — 92	..	5 8 9
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	97 —100	..	5 0 0
Singapore Trams, 5 % Deb.	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	7	7	4⅜ — 5	— 1/16	7 0 0
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛	— 1/8	5 17 1
Do. 5 % 1st Deb.	100	5	5	93⅜ — 96⅜	..	5 3 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	⅜ — ½	..	8 12 4
Do. 6 % Pref.	1	6	6	5/8 — 3/4 xd	..	8 0 0
Babcock & Wilcox	1	16	14†	21⅜ — 21⅝	..	5 8 11
Do. Pref.	1	6	6	1 5/8 — 1 7/8	..	4 3 6
British Aluminium, Ord.	1	..	..	1 — 1⅛	..	..
Do. 6 % Cum. Pref.	1	6	6	5⅝ — 5⅞	..	6 12 6
Do. 5 % Prior Liens Debs.	100	5	5	94 — 97	+ ½	5 3 2
Do. Deb. Stk.	100	5	5	85 — 87	..	5 15 0
B.I. & Helsby Cables	5	10	8†	7⅜ — 8⅛	..	6 1 8
Do. Pref.	5	6	6	5⅜ — 6⅛	..	4 16 0
Do. Deb.	100	4½	4½	100 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	3	Nil	..	1⅛ — 1 3/8	..	Nil
Do. Deb.	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	⅛ — ⅜	+ ⅛	Nil
Do. 5 % Prior Lien Deb.	100	5	5	72½ — 77½	+2	6 9 0
Do. 4½ % Deb.	100	4½	4½	85½ — 40½	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	5†	10½ — 11½	..	6 13 4
Do. Pref.	5	5	5	4¼ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	22½	8⅜ — 8⅝	—1/16	6 0 0
Do. Deb.	100	4½	4½	104 —107	..	4 4 1

Crompton & Co., Deb.	100	5	5	68 — 73	..	6 17 0
Dick, Kerr	1	Nil	..	5/16 — 3/8	..	..
Do. Pref.	1	6	6	3/8 — 7/16	..	7 2 2
Edison & Swan, A, £2 paid	5	Nil	..	0 — 1/8	..	Nil
Do. fully paid	5	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	57 — 61	—1	6 11 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	⅛ — 3/16	— 1/16	7 5 6
Do. Pref.	1	7	7	1⅛ — 1 1/16	..	6 11 9
Greenwood & Batley, Pref.	10	7	7	6⅞ — 7½	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	9⅞ — 10⅜	..	5 15 8
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	10†	12⅜ — 13½	..	5 11 1
Do. Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 8 11
Do. Deb.	100	4½	4½	100 —102	..	4 8 3
India-Rubber, G. & T.	10	7½	5	11½ — 12½	— ½	6 0 0
Do. Pref.	10	5	5	9½ — 10	..	5 0 0
Telegraph Construction	12	20	5†	37 — 39	..	6 3 1
Do. Deb.	100	4	4	96 — 98	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	61 — 65	+2	6 3 1
Do. B 4 % Cum. Pref.	100	..	..	35 — 40	..	..

* Unless otherwise stated all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 2nd, 1913.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING NOVEMBER, 1913.

THE returns of electrical business for the eleventh month of the year show, in the case of the exports, one of those periodic jumps in value which can be traced to a large telegraphic export. In this case Ceylon is credited with a submarine telegraphic purchase, valued at £625,000, and, as a result, the exports for November amounted to £1,135,402 in value, as compared with £554,769 in the previous month.

It may be noted, however, that even excluding telegraphic exports, the remaining general business of November was still some £30,000 to the good, as compared with the preceding month.

Turning to the imports, these amounted to £258,937, as compared with £265,414 in October, showing an appreciable decrease; this also applies to the re-exports, which, with a total of £27,277, show a heavy decrease compared with the £39,337—an unusually big total—recorded for October.

The exports of cable and machinery reached very satisfactory totals, the former being some £20,000 above the value recorded in the previous month; this improvement also applied to telephone exports, and in a less degree to the lamp section. The values of cable, carbons and lamp imports were somewhat above those for October, but this was more than counterbalanced by the falling off in other directions.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,709	67	97	171	4,144	504	11,569	593	468	75	90	3,677	23,164
Germany	2,236	1,175	23	...	73	...	2,729	...	29	...	10	141	6,416
Netherlands, Java and Dutch Indies ...	751	1,225	101	13	...	32	1,436	38	180	196	2	1,132	5,106
Belgium	505	235	60	...	71	39	4,614	...	17	12	1,047	40	6,640
France	409	...	3,382	34	...	112	16,467	44	101	...	246	435	21,230
Portugal	243	27	...	15	...	100	265	...	...	...	27	837	1,514
Spain, Canary Isles and Spanish N. Africa...	1,021	1,027	661	11	...	403	4,619	370	...	20	126	220	8,478
Switzerland, Italy and Austria-Hungary ...	170	64	258	...	100	...	3,655	20	...	809	143	2,693	8,212
Greece, Roumania and Turkey	460	526	217	48	...	48	96	17	...	36	18	6,384	7,850
Channel Isles, Gibraltar, Malta and Cyprus...	95	128	95	21	...	...	253	920	...	...	...	360	1,872
U.S.A., Philippines and Cuba	1,260	...	27	18	...	34	547	...	26	4	...	139	2,055
Canada and Newfoundland	1,031	1,130	949	1,028	12	2,633	10,524	87	962	...	547	698	19,601
British West Indies and British Guiana ...	475	30	...	87	...	4	214	...	...	...	112	38	960
Mexico and Central America	54	...	93	...	...	...	661	...	...	...	575	2,771	4,154
Peru and Uruguay	954	...	...	77	...	140	4,634	...	693	60	114	4,059	10,731
Chile	638	100	225	290	35	50	2,595	...	16	29	586	86	4,650
Brazil	1,956	1,067	646	937	171	105	8,459	1,249	83	...	68	3,436	18,177
Argentina	3,719	15,409	686	2,361	629	496	20,742	2,125	2,433	60	779	171	49,610
Colombia, Venezuela, Ecuador and Bolivia...	89	183	67	...	...	...	889	...	...	...	63	158	1,449
Egypt, Tunis and Morocco	509	235	213	17	...	19	2,914	32	...	...	96	1,143	5,178
British West Africa	94	14	51	...	...	199	117	...	246	8	53	119	901
Rhodesia, O.R.C. and Transvaal	1,552	3,032	688	327	...	150	1,654	244	353	50	...	...	8,045
Cape of Good Hope	1,426	7,930	2,006	248	...	279	5,460	3,534	251	22	5,666	85	26,907
Natal	1,696	6,489	193	120	76	38	3,986	...	271	21	288	58	13,236
Zanzibar, Brit. E. Africa, Mauritius & Aden	165	62	142	130	70	56	965	72	438	14	241	516	2,871
Azores, Madeira and Portuguese Africa ...	244	273	71	25	...	255	4,928	...	137	...	82	134	6,149
French African Colonies and Madagascar ...	...	...	...	...	23	...	...	...	...	...	...	39	62
China and Siam	1,453	987	1,769	160	91	788	2,187	797	37	...	90	360	8,719
Japan and Korea	1,602	51	905	...	3,480	851	8,225	667	3,186	36	11,738	2,725	33,466
India	4,030	10,571	4,407	2,813	142	55	29,061	2,787	1,118	213	1,414	2,767	59,378
Ceylon	336	459	313	91	...	2,891	97	...	145	...	168	625,577	630,077
Straits Settlements, Fed. Malay States, and Sarawak	376	757	689	79	...	637	4,097	357	58	33	773	392	8,248
Hong Kong	548	1,832	233	...	12	...	1,837	...	91	...	84	...	4,637
West Australia	504	1,141	271	358	61	109	272	3,912	29	...	854	16	7,527
South Australia	390	7,387	290	406	20	605	1,101	15	95	4	30	144	10,487
Victoria	1,817	8,870	431	979	99	87	6,356	152	1,476	37	26,310	2,133	48,747
New South Wales	1,815	8,722	707	1,006	931	611	7,156	1,101	871	59	657	7,036	30,672
Queensland	767	616	85	291	...	348	773	30	143	...	2,143	655	5,851
Tasmania	82	...	...	...	...	...	...	...	...	...	...	...	82
New Zealand and Fiji Islands	1,136	3,498	473	1,008	252	846	3,718	397	493	...	10,222	250	22,293
Total, £	38,317	85,319	21,519	13,169	10,492	13,524	180,172	19,560	14,446	1,798	65,462	671,624	1,135,402

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	23	65	...	3	...	...	7,200	...	953	...	5,160	13,404
Germany	3,392	28,191	1,943	20,453	8,547	1,781	42,235	1,300	11,913	12,044	3,084	134,883
Holland	...	569	...	3,550	1,276	4	262	250	...	202	105	6,218
Belgium	563	3,007	16	139	21	35	4,437	...	58	110	4,799	13,185
France	1,417	61	1,427	2,055	292	2,146	757	...	1,101	3,498	368	13,122
Switzerland	300	1,489	172	7	20	106	2,756	...	11	250	...	5,111
Italy	20	13,342	...	...	105	247	...	...	...	...	148	13,862
Austria-Hungary	...	1,403	8	453	274	...	8	...	917	148	172	3,383
United States	4,805	562	671	46	144	60	14,898	30,362	246	597	2,563	54,954
Total, £	10,520	48,689	4,237	26,706	10,679	4,379	72,553	31,912	15,199	16,849	16,399	258,122

Additional imports: Spain, carbons £415; Canada, arc lamps, £260, machinery £140

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	12,729	533	...	3,935	199	...	7,886	...	470	526	999	27,277

TOTAL EXPORTS: £1,135,402. TOTAL RE-EXPORTS: £27,277. TOTAL IMPORTS: £258,937.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

WORKS SHOP ORDER SYSTEMS.

By A. E. BREWERTON, A.M.I.E.E.

How often does it happen in a works when a set of parts come to be assembled, that one all-important component is missing, and the work has to stand whilst it is being made? If we refer to certain classes of mechanical manufacture, the answer might be—"Never"; and truly so, since there are many firms making articles which have been standard for the last ten years or so, where work goes through automatically in its tens of thousands, and, by a very simple system of book-keeping, the stores department is enabled to order the exact material required, and such works may be kept uniformly busy, whilst the orders last, and in half an hour it is possible to take stock of all the work in progress.

Apply the same question to some small electrical works where a variety of articles is made, and where the cost of non-productive labour is kept down to an extent which renders systemising difficult, then the answer must be—"Often."

In electrical work there is no finality of design, and, therefore, systematising remains a difficulty. The cost-keeping system, to a large extent, forms a basis for the works system; and, if the two are not in perfect harmony, the aims of both are frustrated, and their existence is no longer justified. Works managers often have occasion to look upon the cost department as their worst enemy, but it is absolutely necessary that they should assist it as much as possible to ensure their own comfort.

Where special work is taken on by contract, or repairs are being carried out, it is only necessary to have the cost of the whole job. A shop order is, therefore, issued to the works, upon which all time and material are booked; then, as soon as the work is completed, factory charges are added to the labour, the required profit put on as a percentage of the whole, and an ultimate figure, which the estimator always hopes will be below the contract price, is obtained.

The system involved in this class of work is simplicity itself; but when work is done upon a repetition basis, it is necessary to go into matters much more closely, for if finished articles are to be made even in such small numbers as hundred lots, the cost of each component should be known, and must, therefore, have its shop order number, against which material and labour are booked. It is usually advisable, however, to make the first batch of a new line upon one collective order, and subsequently issue the component orders, so as to be sure that unreliable figures are not obtained, due to the experimental stage not having been passed.

Now, in starting a system for repetition work, it seems that some start off in quite a complicated manner, by allowing a multiplicity of numbers to exist. Let us take an example of a "system" in vogue in a works we know, and let us follow the mysteries connected with the brush-holder for a certain motor, which we will call the B type. Now this is what happens.

The drawing office makes a drawing (Numbered 9,999), which is issued to the pattern maker, who numbers his pattern Z111; sometimes a metal pattern is made later which has a further number, but, anyway, the castings ultimately arrive in the stores, and become known as "Brush-holder Castings for B-type Motors." There is no need to recite all the names that this one unfortunate article receives before completion, but let it be said that the tools and jigs for machining, the shop order upon which the work is done, and, finally, the spare part list, all have different numbers according to a so-called system.

For one component it is quite sufficient to have one number, and the system which is described here seems so obvious that were it not that a multiplicity of appellations is often employed in the manner referred to above, it would hardly seem worthy of space.

After all the experimental work is completed, and, perhaps, after the first batch of these B-type motors have been completed, a specification sheet is constructed similar to Table I:—

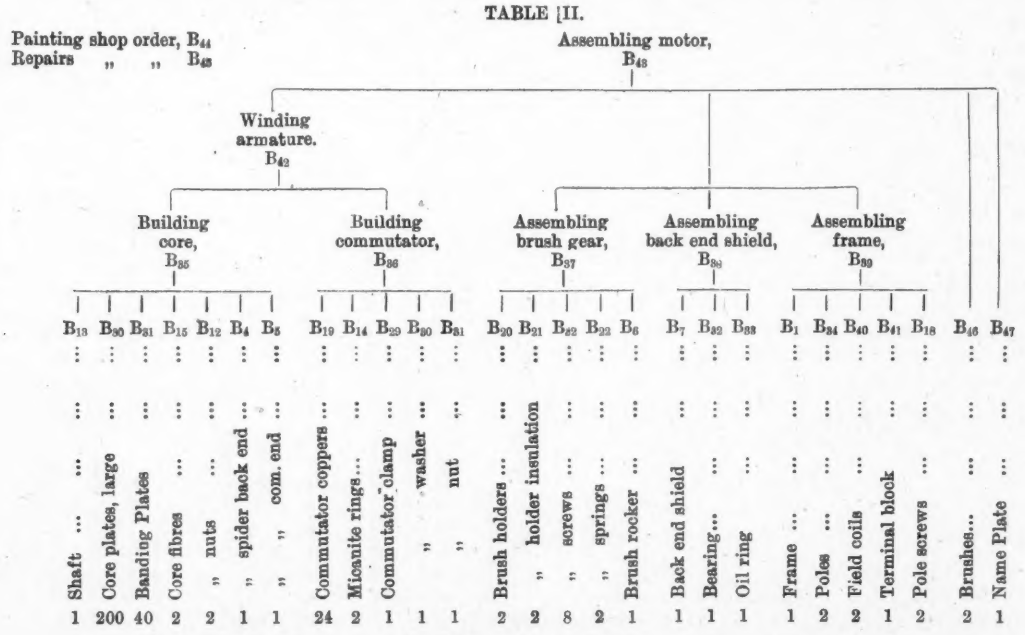
TABLE I.—Specification for B-type Motor.

S.O. No.	Description.	No. required.	Material.	Drawing No.	Remarks.
B1	Frame	1	C_1	In addition to the part or S.O. No., it is convenient to have a further No. for filing drawing; but this is for drawing office use only.	
B2	Back end shield	1	C_1		
B3	Comm. end shield	1	C_1		
B20	Brush-holder	2	Brass casting		

Now each part has been given a number with an index letter B, arranged in some order for convenience—say, starting with cast-iron parts then brass casting, followed by capstan parts, and so on. The number given to the brush-holder is B20, and by this mark it is always known, even in the spare part lists sent to customers, instead of using a long description.

It would not do to make patterns and tools, and debit their cost against production; and, therefore, these should follow a simple series of numbers, so that if there are four

TABLE II.



The figures below the components are intended to represent the number required for assembling.

jigs for machining B20, the cost of each must be known. It is not sufficient to know that the tools have cost too much, without being able to drop on to the offending member if the cost is too high.

When the tools and patterns are complete, any repairs which they may require are, however, booked to maintenance and debited against the cost of production; therefore, to make a distinction between maintenance and actual production, it may be convenient to book the former on shop order BM20 (M, measuring maintenance).

The outcome of this system of numbers is that the man in the stores, or the workman in the shop, need not necessarily know the functions of the various parts, nor remember them by name. He is told to machine a hundred B1's, and provided he gets castings and tools which bear that number, he has no occasion to give more than his habitual amount of thought to the matter.

In our example, we have instanced for convenience one particular type of motor. If we now design a C-type motor, utilising some of the components, there is no disadvantage in including the latter in the new specification under their original numbers.

Such is not the case, however, with a standard range of machines where a large number of combinations is made from comparatively few parts by working out suitable ratings, and making use of whichever armature plate, magnet core, commutator, and frame are best combined for a particular design. In such cases it is advantageous to modify the classification.

In addition to the component part numbers, it is necessary to have further shop orders upon which they may be assembled. One number may be used upon which all assembling is done; but it will usually be found an advantage to divide up this part of the work.

Turning, again, to the motor for our illustration, commutator building, core building and armature winding are distinctly different operations, and should have separate numbers, and when the method of assembling has been decided upon, it has been found to greatly facilitate storekeeping and save a lot of writing on requisitions, to draw up an assembling sheet in the form of a tree, as shown in Table II. Now with a sheet of this kind, if a foreman has to build a hundred armature cores, he does not write a long requisition for 100 shafts, 20,000 core plates, and so on, but just calls for 100 sets of parts for B35. And when those armature cores are complete and returned to the stores, they are known by the number B35, and so on.

It is usually impossible to construct any system for a particular set of circumstances and then apply the same idea elsewhere, even though the conditions of work bear every similarity. The system here described has, however, been found workable and the assembling tree most useful in a case where the stores and cost departments were not thoroughly conversant with new kinds of work, as the stores could see at a glance what components were required, and the costs clerk having a partly assembled article could see immediately the parts which it includes. Table II only includes a few parts to illustrate the system, but when a sheet is drawn up for assembling a hundred or so parts, its usefulness becomes more apparent. It will readily be seen that with a sheet constructed upon these lines, the work of assessing the value of partly assembled stock becomes very simple.

ELECTRICITY AND RESPONSIBILITY FOR FIRES.

[FROM OUR LEGAL CONTRIBUTOR.]

It frequently happens that when a country mansion or other establishment is burnt down the blame is laid at the door of him who laid the cables for electric lighting. It is one of the charges "random hurled," refutation of which is not easy if the electrical installation is destroyed with the building. Whatever may be the probabilities of the case, it is often found convenient to attribute blame either to the persons who put in the electrical installation or to the supply company, especially where the premises which have been destroyed are not insured. In view of this possibility, it may be of interest to discuss some of the legal problems which arise.

The first question to consider, is whether and how far a company or local authority supplying electricity under the terms of a provisional order may be held liable for a fire upon a consumer's premises. Much appears to depend upon whether the undertakers (to use a collective word) are responsible for the actual installation on the consumer's premises.

If a company (or a local authority) carry out this work, their liability will be co-extensive with that of the independent wiring contractor, whose position has already been considered, subject to this, that a local authority will be entitled to the benefit of the Public Authorities Protection Act, 1893, which provides that an action of this kind shall be brought within six months of the date of the alleged injury, and that, if the local education authority are successful, they may be entitled to costs on a higher scale.

The liability of "undertakers" is not, however, restricted to cases in which they have supplied wires and fittings to a consumer. The Electric Lighting Acts expressly provide that they shall be liable for any negligence or nuisance in the supply of electricity, and this liability is strengthened by the Board of Trade Rule 36, which provides that:—"The undertakers shall be responsible for all electric lines, fittings and apparatus belonging to them, or under their control, which may be upon a consumer's premises, being maintained in a safe condition, and in all respects fit for supplying energy." So, if they merely hire fittings, &c., to a consumer, they are liable. Rule 37 provides that:—"In delivering the energy to consumer's terminals the undertakers shall exercise all due precautions, so as to avoid risk of causing fire on the premises."

It may be inferred, however, that undertakers are not insurers; they must be proved guilty of negligence before they can be charged. Reverting to "gas cases," we find this principle clearly established.

In Holden *v.* Liverpool Gas Co. (1846) (3 C.B. 1), a gas company, incorporated by Act of Parliament, had for some years supplied gas to a house belonging to the plaintiff, the only means of shutting it off being by a stop-cock within the house, the key of which was kept by the occupier. The last tenant, on quitting, gave notice to the company that he should not require any further supply; and one of the company's workmen, at his request, removed a chandelier from one of the rooms, leaving the end of the pipe properly secured. The internal fittings were the property of the plaintiff. Whilst the house remained untenable, the gas, by some unexplained means, escaped, and an explosion took place, by which the house was considerably damaged. In an action for damages brought against the company, alleging a breach of duty on their part in not taking proper means to prevent the influx of gas into the house, it was held that a non-suit was rightly directed on the above facts. Again, in an action against a gas company for negligently allowing the escape of gas from their mains into premises where lights were known to be burning, it was shown that the gas found entrance through an open window nearly level with the trench from the main, after a hole had been made in the main for the insertion of the service pipe. It was decided that even if the jury thought that the gas entered in the manner alleged, it was a question for them whether the company's men might reasonably have foreseen it and were bound to have the window closed.

In Burrows *v.* March Gas and Coke Co. (1872) L.R. 7 Ex. 96, the defendants, a gas company, having contracted to supply the plaintiff with a service pipe from their mains to the meter on his premises, laid down a defective pipe from which the gas escaped. A workman in the employ of a gas fitter, employed by the plaintiff to lay down the pipes leading from the meter to different parts of the premises, negligently took a lighted candle for the purpose of finding out whence the escape of gas proceeded. An explosion then took place, whereby damage was occasioned to the plaintiff's premises, to recover compensation for which the plaintiff brought his action against the defendants. It was decided that the damage was not too remote, and that the plaintiff, not being the master of the workman,

could not be construed as contributing to the damage by reason of his act, and was, therefore, entitled to recover.

In a later case (Henderson *v.* Newcastle and Gateshead Co. (1893), 37 Sol., J. 403) the plaintiff owned a new house, which was divided into two separate flats, an upper and a lower one, each flat having a separate entrance into the street. When the house was built the plaintiff laid a service pipe for gas from the street under the hall door-steps, inside the wall of the house to the upper flat. The tenant to whom the upper flat was let gave notice to the defendants, under Sec. 11 of the Gasworks Clauses Act, 1871, requiring them to give a supply of gas to the flat. The defendants thereupon made the connection by a pipe from the main under the street to the service pipe, and supplied and fixed a meter in the flat and turned on the gas. About an hour afterwards an explosion took place, caused by an escape of gas owing to a defect in the service pipe, which the plaintiff had laid, leading to the meter. In an action to recover for the damage done to the house by the explosion, the plaintiff contended that it was the duty of the defendants to see that the pipes by which they supplied the gas to the flat were fit for the purpose; that as the gas belonged to the defendants until it passed through the meter, it was not supplied to the flat until then; and that if the defendants chose to make use of a pipe not laid by themselves, it was their duty to test it to see if it was in good condition. At the trial, Mr. Justice Collins, as he then was, ruled that there was no duty on the defendants to test the service pipes, and, the jury having found that the defendants had made the connections properly, and had not caused the defect in the service pipe, judgment was entered for the defendants. On motion for a new trial, the Court of Appeal dismissed the application, holding that there was no duty on the defendants to test the service pipe laid by the plaintiff, and the case was distinguished from Burrows *v.* March Gas Co., where the service pipe was supplied and laid by the gas company.

A gas company are bound to keep up such a reasonable inspection of their mains and pipes, as may enable them to detect when there is such an escape of gas, by fracture or imperfection of pipes, as may lead to danger of an explosion; and if an explosion takes place from a fracture or defect which has existed for several days, during which time it has also been discoverable by reason of the smell of the escaped gas, and would have been discovered by proper inspection, that is evidence of negligence on the part of the company; nor is it enough to relieve them from liability that, upon notice of the escape, they sent a workman to repair the defect, he arriving too late to do so. (Moss *v.* Hastings and St. Leonards Gas Co. (1865), 4 F. and F. 324.)

Passing next to the wiring contractor, there does not appear to be any case in the law reports where a wiring contractor has been liable for a fire traced to defective insulation; it cannot therefore be stated that his legal liability has been accurately defined. Nevertheless, on general principles it is apprehended that where a man undertakes to put in wires, it is an implied term that he will see to the insulation being safe and sound. If he does not do this, he is liable for the consequences; and if it were conclusively shown that a fire was caused by a short-circuit, the wiring contractor might be held liable for the damage. In ascertaining the state of the law relating to electricity, it is often necessary to obtain assistance by referring to cases which have arisen in connection with the supply of gas. Cases of this kind are of some use in this connection. In the case of Blenkiron *v.* Great Central Gas Co. (3 L.T. 317), the plaintiff was possessor of certain premises, and the defendant was employed in laying on gas to the premises adjoining; he did the work so negligently that the gas escaped and ignited, and the plaintiff's premises were set on fire and burnt down. It was held that there was a good cause of action; that it was unnecessary to negative negligence in the owner of the adjoining house in not putting out the fire before it communicated with the plaintiff's premises. While the principle underlying this case probably applies to a man who is employed to fit up electric wires, it is, of course, clear that proof of negligence, and of the fact that the fire was started, would be much more difficult in the case of electricity, but it is submitted that an electric wiring contractor may be held liable if his negligence be proved; and this whether the current is supplied from public mains, or from a private supply.

Where electricity is thus supplied, viz., under Sec. 4 of the Electric Lighting Act, 1888, the Board of Trade rules provide that:—"The owner shall be responsible for all electric lines, fittings and apparatus belonging to him, or under his control, which may be upon a consumer's premises being maintained in a safe condition, and in all respects fit for supplying energy." The expression "owner" means any body or persons owning or using, or entitled to use, any electric lines or works, upon whom notice has been served by the Board of Trade requiring that such electric lines or works shall be continued and used only in accordance with the rules of the Board. The liability of an "owner" in these circumstances is very similar to that of an ordinary "undertaker," but here again the owner is only liable (under the rules) if the lines on the consumer's premises remain his property. Where, however, he acts as "wireman" and supplies the fittings, there will be upon him an implied obligation to provide wires and fittings which are free from defects.

While the cases above referred to make it clear that electrical undertakers may be held liable for damages caused by fire, they also appear to establish the fact that the existence of a fault must be proved.

THE ELECTRICITY SUPPLY OF LARGE CITIES.

By Prof. G. KLINGENBERG, Dr. Ph.

(*Abstract of address delivered before the* Institution of Electrical Engineers, *December 4th*, 1913.)

There would be no demand for other forms of energy if all electric supply undertakings would fully recognise the advantages which our present-day knowledge and experience places at their disposal, and if they could rid themselves of the restrictions originally placed upon them in the supposed interests of the consumer, which restrictions are now very often found to be a hindrance to both consumer and producer.

It is the purpose of the present paper to explain the nature of these conditions and draw attention to those factors which would contribute towards a reduction in the cost of electricity and facilitate its more extensive employment.

Referring to existing conditions I have confined myself to three typical examples. The cities selected are Berlin, Chicago, and London, and the figures are based on the following years:—Berlin, 1911-12; Chicago, 1911; London, 1910-11.

In Berlin the electricity supply began with the purchase and operation of generating sets by commercial undertakings solely for their own requirements, and without intention of selling energy to outside consumers. This system was found to be convenient, as it was not necessary to lay conductors in the streets, and as complete independence of municipal authorities was possible. A number of these so-called "block stations" still exist, their combined output being estimated at nearly 40,000,000 KW.-hours. The Berliner Elektricitätswerke alone formed an exception in this respect; they were intended from the outset to supply current to outside consumers. They were also able to form a new supply area beyond the Berlin boundary, and to take financial interest in new undertakings. The price at which the current is supplied must be reduced when the net profit exceeds 12½ per cent. on the share capital. The city receives 10 per cent. of the company's gross income, and half the net profit after paying 6 per cent. on the share capital up to M.20,000,000, and again half the profit left after paying 4 per cent. above this amount. The sum paid out in this manner during the past financial year, for example, was M.7,184,000 (£350,000), which considerably exceeded the dividend paid on the company's share capital of M.64,100,000 (£3,150,000). The development of the Berliner Elektricitätswerke may be seen from the following figures for the energy sold:—

1900-1	Energy sold	= 69.700,000	KW.-hours
1905 6	"	= 126.200.000	"
1910-11	"	= 192,100,000	"
1912-13	"	= 244,300,000	"

The distribution in Berlin itself is on the continuous-current system throughout, with the exception of the suburbs and a section of the city in the north, which are fed directly with three-phase current.

In addition, a number of separate stations exist which supply energy to the underground railways and a part of the tramway system.

The Chicago electricity supply originated in a large number of small supply companies (approximately 36). In 1907 the com-

panies were amalgamated under the title of the Commonwealth Edison Co.

All the small power stations have been shut down since then, and the whole supply is obtained now from four large power stations. The concession extends over a period of 50 years, dating from the year 1897, and it stipulates the maximum rates to be charged by the company, and a payment of 3 per cent. on the annual gross receipts to the city.

The development of the company may be seen from the following figures for the energy sold :—

1900	Energy sold =	33,700,000	KW.-hours
1905	" =	93,000,000	"
1910	" =	550,000,000	"
1912	" =	712,000,000	"

The sub-stations are fed with three-phase current at 9,000 volts, 25 cycles, and in part at 20,000 volts, 60 cycles. The distribution in the interior of the city is on the continuous-current system, while in the outlying districts three-phase current at a frequency of 60 cycles is adopted.

Electricity supply in London began, as in the case of Chicago, with a number of private companies. Their development was hampered, however, in the earlier stages by legal restrictions, which limited the concessions to a period of 21 years, and divided the current supply of the City into a number of districts corresponding to the administrative divisions, without taking into account the natural development of the distribution system. Every authorised supply undertaking was obliged to erect its own generating station and to lay out its own distributing network. An amalgamation of the different concerns was, therefore, out of the question until, in 1908, the original Act was modified by a new Bill. Since that time constant endeavours have been made to combine the numerous companies, to centralise the generation of energy, and to standardise the different distribution systems as far as possible.

I now propose to discuss the factors which determine the price of electrical energy. The cost of the plant per installed kilowatt should be mentioned in the first instance. In the power station the cost per kilowatt decreases rapidly as the size of the generating sets increases. For works with modern generating sets of 1,000 KW. capacity the installation costs are found to be approximately £15 per kilowatt, whereas for units of 20,000 KW. capacity they only amount to one-half of this sum. Bearing in mind that for large cities outputs of several 100,000 KW. are required, one will realise that units of less than 20,000 KW. capacity are unsuitable and too expensive for this purpose, and the installation of 30,000-KW. sets appears to be fully justified. In consequence of this development, the specific cost of power stations has fallen in about 10 years to nearly a quarter of its former value.

The conditions are not so favourable, as a rule, for the network. It is, nevertheless, possible to economise on the capital outlay of the distribution system. The use of higher working voltages should first be mentioned. The customary feeder cables for pressures of 6,000 to 10,000 volts no longer meet present-day requirements in large cities. Whenever extensions are contemplated, pressures of 20,000-30,000 volts should be adopted, at which it is possible to transmit outputs of more than 10,000 KW. through one cable. The cost of the feeder cable is reduced to about 2s. 6d. per kilowatt transmitted and per kilometre. A further means of reducing the cost of the network is found in the conversion of the entire system to a uniform A.C. system, by laying ring mains and by interconnecting the various sections of the city.

In my opinion, interest at 6-8 per cent. on the value of the plant represents for undertakings of this kind the lowest limit which would ensure a favourable market for the company when it requires further capital. As regards the sinking fund and other reserves, an average figure of 3-4 per cent. seems to be reasonable for power stations, sub-stations and distribution system ; for long-distance transmission lines and feeder cables in which the conducting material (copper) represents a high percentage of the total value, about 2 per cent. may be sufficient. I have therefore based the following calculations upon uniform capital charges of 10 per cent. for power stations, sub-stations, and distribution system, and 8 per cent. for transmission lines and feeder cables, and I have called the current prices calculated from this basis "normal prices."

The costs of generation are directly dependent on the size of the power station, or on the size of the generating sets. Power stations with units of 20,000 KW. capacity consume only about three-quarters of the quantity of coal at full load compared with works in which modern 1,000-KW. sets are installed and only half, or even less, of that consumed in older power stations with units of this size. The operating staff required depends chiefly upon the number of machines and not upon their size ; therefore labour costs are far more favourable in plants with large generating sets. The same applies to the sums required for repairs, stores, and general expenses. By sub-dividing the distribution system in accordance with the best engineering practice, one can effect economies. Here again attention should be drawn to the superiority of the A.C. systems over the mixed systems.

The transmission losses, which in the old plants amount to about 20 per cent. of the energy generated, and thus represent from 10 to 15 per cent. of the selling costs, can unquestionably be reduced to half this figure with the enlargement and standardisation of the plant, this being all the more the case in view of the fact that lower generating costs also reduce the cost of the losses.

The utilisation of the plant can be expressed by the following formula :—

$$u = \frac{\text{KW.-hours sold per annum}}{\text{installed capacity of plant} \times 8{,}760} = \frac{\text{average load sold}}{\text{installed capacity}}.$$

This term has been in use for some years on the Continent. I have called it the "utility factor" (u) of the plant. The use of this factor affords valuable assistance in arithmetically following up the somewhat intricate relations between the cost of the current and the utilisation of the plant.

The total selling costs per KW.-hour are found to be equal to the sum of :—

Proportion of costs referred to the power station, including capital charges.

Proportion of costs for the transmission and distribution losses, including capital charges.

Proportion of costs for the operation of the transmission system, including capital charges.

And they can be represented by a single equation—

$$K = a/u + a_1/u^2 + b \text{ shilling per KW.-hour sold,}$$

which is called the costs characteristic for the entire plant. With this equation one can ascertain the average energy costs for the entire plant, and one can also graduate the prices payable for the

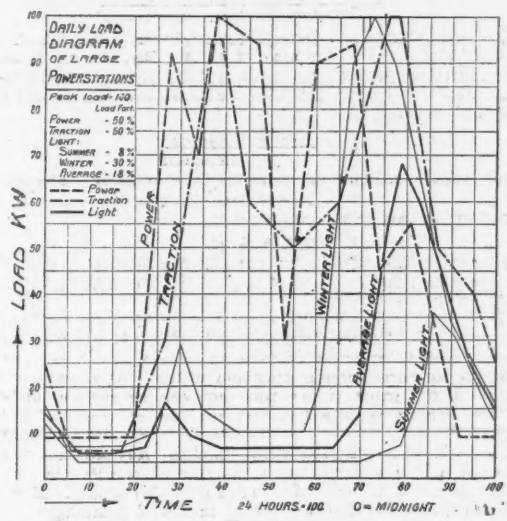


FIG. 1.

various classes of consumption in correct steps as soon as their individual influence upon the utility factor is known.

The load factor m is given for the entire plant by the ratio between the average load of the power station and the peak load, and can be expressed by the formula—

$$m = \frac{\text{KW.-hours generated per annum}}{\text{peak load} \times 8{,}760} = \frac{\text{average load}}{\text{peak load}}.$$

This value is proportional to the utility factor.

Characteristic load curves for power, traction and lighting are shown in fig. 1. The maximum load in all three cases is assumed to be 100, the day of 24 hours being divided into 100 parts, beginning at midnight. The load factors are—

Light	...	*ca.* 18 per cent. (Sundays excluded)
Power	...	*ca.* 50 " " "
Traction	...	*ca.* 50 " " "

From these standard curves we can obtain the resultant load curve, and also the resultant load factor "m," for any desired combination of lighting, power and traction consumers.

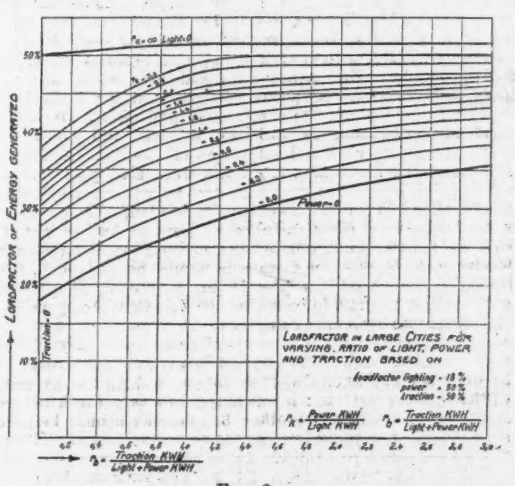

LOADFACTOR OR ENERGY GENERATED
LOADFACTOR IN LARGE CITIES FOR VARYING RATIO OF LIGHT, POWER AND TRACTION BASED ON
loadfactor lighting - 18 %
power - 50 %
traction - 50 %
Power-6
Traction-6
Power KWH / Light KWH
Traction KWH / Light+Power KWH

FIG. 2.

In order to include all conditions which have to be taken into account, and which are affected by various combinations of consumers and the degree of centralisation, a further diagram has been drawn up, fig. 2, based on the load curves given in fig. 1. From this

diagram the resultant load factor can be taken directly as soon as the percentages for power, traction and lighting are known. If, for instance, the KW.-hours consumed comprise 20 per cent. lighting, 12 per cent. power, and 68 per cent. traction (this approximately resembles the conditions in Chicago for 1911), then the resultant load factor lies at the intersecting point of the curve $r_k = 12/20 = 0{\cdot}6$, with the abscissa value $r_b = 68/(12 + 20) = 2{\cdot}13$, according to which a resultant load factor of 40 per cent. for the above relationship may be expected, and which approximately corresponds to the actual value obtained, namely, 41 per cent.

This diagram demonstrates the important fact that by superimposing power and traction curves (top curve $r_k = \infty$) the load factor may be improved only by 2 to 3 per cent., while, on the other hand, by combining the power and traction supply with a lighting load of about 12 per cent., the resultant power factor is not materially decreased.

Next to the load factor, the efficiency of the network has to be taken into account in determining the utility factor. This efficiency is expressed by—

$$\eta = \frac{\text{KW.-hours sold}}{\text{KW.-hours at feeder bus-bars}},$$

This value is again in direct proportion to the utility factor.

The third point is the amount of stand-by, the utility factor being inversely proportional to the capacity of the stand-by. This percentage can be reduced with the increase in size of the total plant. The stand-by factor is—

$$r = \frac{\text{installed output}}{\text{peak load in station}},$$

where the decimals indicate the percentage in spares. The relation between utility factor, load factor, distribution efficiency and stand-by is given by the formula—

$$n = m \times \eta \times 1/r.$$

By inserting this value in the equation for the cost characteristic of the plant, the influence of any of the above factors upon the cost can be ascertained.

It is now proposed to give a summary of the operating conditions in the Berlin, Chicago and London plants. The author has succeeded, by making some assumptions, in determining the relation between working costs and utility factor, and has thus obtained the equation for the costs characteristic of all three plants. This conversion appeared to be necessary since the plants in question have totally different kinds of consumption, and therefore work with different utility factors. Any attempt to draw general conclusions on the advantages of one system over the other is bound to be misleading, unless this is done. Moreover, this analysis seemed to be the only means of obtaining a positive indication of the influence which the difference in centralisation of the three plants exercises upon the working and current costs.

(To be continued.)

Discussion.

Mr. John F. C. Snell, who opened the London discussion, said the author had indicated what any engineer would do if he were to tackle the London electricity supply problem afresh, but in London the L.C.C. had powers to purchase the companies in 1931, and no one know exactly what the terms would be, and this uncertainty made it difficult for the companies to raise money. In the case of a moderate-sized station, the cost of extension was not very high, and the production cost with modern plant was really small, so that it was a difficult matter for bulk supply to compete with extended plant. A bulk supply would always be preferable to building a new station in London, but a saving in one direction might be neutralised by conversion and transmission losses. As regarded the comparison of costs between Chicago and London, the cost of plant, &c., was, roughly, £69 per kilowatt in the first case, and £80 per kilowatt in the second. Some 700 million units were sold in Chicago, but no less than 480 millions were sold for traction at, say, ·408d. per unit on a 50 per cent. load factor; this left some 230 million units for lighting, sold at an average of 2·3d. per unit. This figure compared with about 250 million units, and an average of about 2¼d. per unit for similar uses in London. In London the supply averaged about 70 units per head of population, in Chicago it was 100 units, but it was 100 units in the Marylebone area of London. In New York, 119 units, and in Boston, 110 units were sold per capita. The whole point lay in the fact that the transporation systems were not developed to the fullest extent in London. There was 310,000 KW. of generating plant installed in London, but 36 per cent. of this was reserve plant, due to the numerous small stations in use. Replacement by new bulk stations would, he estimated, enable a saving of about a million pounds per annum, or 26 per cent. in cost to the consumer, to be made. He felt that the moment when the various undertakings could have been purchased had gone by, and that consolidation was more difficult now in view of the new railway power houses, which were being put up. From personal knowledge he believed that it would pay to keep and extend eight of the existing stations; it would pay to retain seven others to a limited degree, while the other 36 stations should be gradually superseded. Including traction requirements, he looked forward to the normal addition of 150,000 KW. of plant during the next 10 years, and it would be unwise to spread this over a great number of stations. He thought, therefore, it might be wise to build a big station and gradually take over this load, the best solution being for one authority to undertake the generation and sell to the authorised distributors who would continue this work as at present. The author's proposal for colliery power stations involved difficulties with condensing water; the first cost of such a plant with transmission would be very high, and no account had been taken of battery costs, although batteries would be necessary. After reviewing the various estimates of cost for a distant and near station, and taking into account the estimated saving in cost of fuel, in the first case, he came to the conclusion, which agreed with the result of careful consideration some years previously, that any new station would be best situated not more than 10 or 15 miles from London.

Dr. Ferranti regretted that many of those whom they would have liked to have heard were at the moment precluded from speaking. Probably many business men in other countries felt that we were a curious people to put up with the conditions existing in London. These conditions originated in the preponderance of the politician over the business man and engineer; usually when the politician started out to benefit the public, the latter was nowhere. In London each area had its own little pet; in some areas it was deliberately arranged that opposing companies should supply A.C. and D.C. respectively, so the author must not imagine that the conditions were the result of considered design. The author undoubtedly showed a saving in cost, but such an argument would not, the speaker thought, be sufficient to alter the existing arrangements. There must be some great advantage to the public, such as a great cheapening of the cost of supply, and he had always felt that when electricity supply developed as it should do, the increased output would be so great as to justify the cost of making the change. Where there was combustion, there was a demand for electricity, which must be supplied from outside the town. He agreed with Mr. Snell, that in regard to distant stations the water supply was a governing factor; a station should be near the river or sea. The problem before them was to supply people with what they wanted, but in the way the supplier wanted. Any supply scheme must take account of the future demand for the whole district, and despite London's size, it could not be considered apart from the adjoining areas.

Mr. A. H. Seabrook, referring to the partnership basis existing in Chicago and Berlin, said the latter city seemed to have made the best bargain. He was glad to note that the author agreed that the surplus from lighting should be available to assist in developing "other uses." It might be as well to consider the question of gasifying coal and recovering the by-products now, and he suggested that the Kent coalfield as a site for a power station would also solve the water difficulty, being near to the sea.

Mr. Wm. C. P. Tapper thought the author's proposals were not practicable; to unify distribution systems would be most costly, and if A.C. distribution were adopted, much more copper would be required to provide against low power factors. He thought the author had overlooked the question of diversity factor, and entirely disagreed with him and Mr. Seabrook in the matter of making concessions to one class of consumer at the expense of another.

[Mr. Seabrook said his point was that a smaller profit could be accepted from a class of consumer which it was desired to encourage, and Mr. Tapper replied that he disagreed with the principle.]

The Author, in replying, said that in many ways he considered the three-phase system the best for distribution purposes, but he had only referred to high-pressure distribution to sub-stations in his paper. The effect of diversity factor has been taken into account in the paper, and could be inferred from its influence on load factor. The cost of lighting energy, owing to the expense of distribution, was bound to be greater than the cost of traction energy; the price charged must be a commercial consideration. His paper dealt with the London problem, in the abstract only; and as regarded the capital costs which had been criticised, he pointed out that he had built a station near Cologne recently, using 8,000 KW. units, and cooling towers, for 175 marks per KW., and he was quite prepared to adhere to the estimated costs given in the paper.

Prof. Klingenberg's paper was also discussed at a meeting of Scottish Local Section at Edinburgh, on Tuesday, December 9th.

Mr. F. A. Newington (Edinburgh) pointed out that while the author had taken three cities which he considered typical, London was the very worst example that could be taken in this country, because London started in the very early days of electricity, when under a benevolent government it was cut up into a large number of small areas, each supplied by one or two small undertakings, the object being to prevent a monopoly as in the case of gas. Now they saw that that was a great mistake as it had rendered it impossible to have a general supply from large stations. The author assumed that it might be possible to scrap the whole of the present stations and to build large new central stations, but he did not know how the Professor was going to get over the enormous capital difficulty. He believed the whole outlay was over £36,000,000. The existing mains the Professor thought would do, but the generating plant would have to be scrapped and that might mean writing off between four and five millions. The professor did say that the paying-off of the debt had been allowed for, but he did not show how. In his (Mr. Newington's) opinion this would very much outweigh the benefits of the new generating stations. Berlin seemed to be very fortunate, in that when the larger stations were started, he supposed the individuals who were running small private stations shut them down or still used them, but there was no question of attempting to buy up these undertakings. In Chicago they bought up the old undertakings for 10 or 15 per cent. of the cost of the new works, which was an extremely low price. The paper might be of value 20 years hence when the local authority of London, or the London County Council, would be considering the buying up of the present undertakings.

The author suggested transmitting 10,000 KW. through one cable; that, of course, with the Board of Trade Regulations as they were at present, they could not do. Further on the Professor talked about 20 per cent. loss in transmission in the other systems. With continuous-current systems at any rate that was far too high a figure —7 or 8 per cent. was a great deal nearer—and he thought that if a city was not too large for low-tension supply, the loss must be less than with high-tension supply and transformation. With the long distances they must use high-tension transmission, but the loss must be greater. Subsequently in the paper the author gave a figure of 50 per cent. load factor for power and 50 per cent. for traction; 50 per cent. for power was far too high a load factor. That was to say, that the works were operating at their full output for 12 hours a day; where did that happen? 20 to 25 per cent. was a much more likely figure than that given 50 per cent. for traction was far too high; he thought 30 per cent. would be nearer the mark. The most important point in the matter, however, had been left out, and that was the selling price. So far as he could see, the only reference to that was where the author said that the selling price in London was 13 per cent. lower, and in Berlin about the same percentage higher than the normal value. Did he take Chicago as the normal? If so, London was not doing badly.

Mr. SAM MAVOR thought there could be no doubt whatever that the association in the same power station of general plant for lighting, power and traction in large cities was a proper policy, and the economies to be derived from that were quite well brought out in the paper. The figures given for the relation of the stand-by plant to the peak load appeared to him to be very high for stations of different capacities. Even if generators only were included, the figure of 40 per cent. was extremely high; even 25 per cent. seemed to be very high for large plants unless the individual units were very large, and the size of the individual unit must have a bearing on the size of the stand-by plant. If a station with a capacity of 100,000 KW. was composed of units of 10,000 KW. it could do with less than 25 per cent. above the peak load. He thought this whole subject must remind them of the prescience of Dr. Ferranti, but his very bold scheme at Deptford unfortunately did not realise anticipations, largely because the generating plant was not at that time available to carry it out. He also missed any direct reference to the selling price, and that was a very important factor. In Glasgow they had selling costs lower than any other city he had heard of. In his own case for domestic supply the average cost for lighting, heating and other purposes amounted only to about 1¼d. per unit.

MR. W. L. SPENCE referred especially to the influence of combined load-factors upon reduction of cost of supply. He agreed with the author that it was not of importance to reduce the cost of traction supply, for two reasons: The cost of power for traction was a very small proportion of the operating cost; and in the second place, he thought electric tramways were a horrible anachronism, and they ought to be swept away for something more up-to-date. It was shown that the load factor of lighting was 18 per cent., and its influence upon the total load-factor was very small. If that was so at the present stage of electric lighting, the argument was likely to be greatly strengthened as time went on, for they were not in sight of ultimate efficiency in lighting, whereas they were in the transformation of electric energy into power and heating.

MR. SIMON disagreed with Mr. Newington as to London being a bad example to take for comparison. The conditions in the Metropolis were not at all dissimilar from those in other cities with a large population, and what applied to a large city would apply to a large area. The present conditions made it difficult for manufacturers and others to get the necessary different stocks or even to manufacture them, and this must tell on the prices. Any system which would conduce to greater uniformity and cheapening of costs must have serious and immediate consideration.

MR. SEDDON said it seemed that the question of the individual load factor was entirely wrong, for cost depended upon the station load factor. The scrapping of existing plant was a very important consideration when one had paid a large price per KW. for small plants, and the law which said they could not scrap the plants before paying for them had to be considered.

MR. HELME considered that what was wanted in London was not the limiting of the natural load factor, but better catering for the consumer in the matter of heating and cooking. Central-station engineers had been far too anxious in the past to get large individual works upon their mains; that often resulted in cutting prices to such a rate that it was debatable whether they could generate for the price secured.

The CHAIRMAN thought it was remarkable that the London stations came out so well as they did, when they considered that many of those small stations had no condensing apparatus and the transport of coal was very costly. If they deducted from the Berlin costs the amount of municipal participation, the relative costs were: London 1·024; Berlin ·612 and Chicago ·54. If London was to be taken as the best they could do in the way of developing electricty it was not a fair comparison. There were pioneer companies in London with obsolete plant, which were under legislative conditions that did not exist at all upon the Continent. The purchase conditions of the Act of 1888, which extended the period during which a company could operate an undertaking before purchase to 42 years, had never yet been defined in a court of law, and the result was that the companies in London at the present time were working towards the time when they knew they would be bought out, but they had no idea of the conditions upon which they would be bought; it might be scrap value, or it might be something better, and under these circumstances it was not to be wondered at if the companies hesitated to spend large sums of money in building more stations for bulk supply. It seemed a feasible thing to put down generating stations in a coalfield, but the nearest coalfield to London was about 60 or 70 miles off, and when they did come to the coalfields they might find that something might be wanting which was quite as important as cheap fuel in a modern power station. The turbine was dependent as much on a cheap water supply as upon a cheap coal supply, and the site of a station must be chosen where there was both cheap coal and cheap water. Dr. Klingenberg informed them that the Berlin municipality got 10 per cent. of the gross income of the supply company, and participated in the profits when a certain percentage had been earned. They heard a great deal of the wickedness of taking profits from electricity undertakings in aid of the rates, but nobody here had suggested that anything like 10 per cent. of the whole income before the profit was declared should go in aid of the city treasury. Such a charge as that, which meant in this case more than the whole coal bill, was undoubtedly a big charge against consumers, and he did not think it was a proper or fair thing to make the industry pay such a charge.

MR. LACKIE said he agreed with Mr. Newington that there was no comparison between London and Berlin and Chicago. He believed the load factors mentioned in the paper could be got with the universal supply of electricity. It was only a few years since a Glasgow firm generated as much as the city was doing, and on a load factor equal to 60 per cent. He believed that the tramway load in Glasgow had only a 36 per cent. load factor, but in Chicago the load factor over all was 41 per cent. He thought the only thing mentioned in the paper about spare plant was that there should be 1 unit spare; out of four 10,000-KW. sets there should be at least one spare. The putting down of a station near a coal mine raised a very debatable question. If they did so they were tied there, and if a coal strike took place there, where were they going to get their coal from? It was better to be so situated that they could get coal from any pit. In Chicago they were building three large stations on one site, within 20 miles of good coal, and yet they believed that it was right to build inside the city and bring the coal in. For units sold per head of the population, Greenock held the record in this country at 135, which was double what it was in Glasgow; that showed that the nature of the load was largely power. The amount of capital spent in Chicago in putting down battery substations last year was half a million pounds. They believed there that they must do everything to ensure reliability of supply, and the whole of the centre of the city could be lit from storage batteries if necessary. This meant a rise of £2 per KW. in the cost of the plant.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

AUSTRALIA.—The Customs Authorities have issued new regulations regarding the certificates of origin required in order to obtain entry of goods under the Preferential Tariff applicable to British goods. It is now laid down that in instances where manufacturers' invoices accompany suppliers' (*i.e.*, middlemen's) invoices and it is clear from the marks and numbers or other evidence in the documents that the manufacturer was aware that the goods were destined for Australia, the certificate of origin for Preference must be made in the manufacturer's invoice if entry is desired under the tariff for British goods. Suppliers' invoices and certificates will, however, be accepted until March 1st, 1914, but importers are to be informed of this time limit in cases where manufacturers' invoices are submitted of the kind referred to above and not bearing certificates. The following new regulation has also been made:

Manufacture in United Kingdom.—Provided the conditions prescribed have been complied with, preferential treatment will be accorded to goods the manufacture of which has been partially effected outside the United Kingdom, on condition that the goods have been subjected to their finishing processes in the United Kingdom and that the total British labour calculated in accordance with the provisions set out in these Explanatory Notes represents not less than one-fourth of the works cost of the goods.

The former regulation read "providing such finishing processes represent one-fourth of the works cost of the goods."

The Customs Authorities have also issued a decision to the effect that "electrical appliances—coils, translator for telephones" shall be dutiable at the rate of 20 per cent. *ad val.* if of British origin and 25 per cent. *ad. val.* if of foreign origin.

NEW ZEALAND.—The New Zealand Customs Authorities have issued the following decisions as to the duties to be levied on certain electrical and similar goods on importation into the Dominion; the duties are in all cases those leviable under the Preferental Tariff granted to British goods:—

Lightning protectors, switchboards, wall terminal blocks, micro-telephones and telephone head receivers, and breast transmitters, 20 per cent. ad. val.

"'Delco" lighting, starting and ignition system for motor cars, consisting of an electric battery, dynamo, and switch: if imported attached to chassis, free; if imported separately, dutiable according to class by parts.

BRAZIL.—The special surtax of 2 per cent. on goods imported into Brazil via Para has been re-established to date from November 1st.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

28,206. "Electric night-lamp combination adaptor fitting." E. Wilson. December 8th.

28,234. "Mechanism for producing a step-by-step motion by electrical means." Eversheds & Vignoles, Ltd., and J. C. Needham. December 8th. (Complete.)

28,267. "Sparking-plugs." M. Pognon. December 8th. (Convention date, December 31st, 1912, France.) (Complete.)

28,277. "Line or wireless telegraph systems." W. H. Shephard and A. E. McKechnie. December 8th.

28,278. "Line or wireless telegraph systems." W. H. Shephard and A. E. McKechnie. December 8th.

28,286. "Electrodes for search-lights." Geb. Siemens & Co. December 8th. (Convention date, December 7th, 1912, Germany.) (Complete.)

28,291. "Electro-mechanical switching-systems for inter-connecting telephone lines." H. Baron. December 8th. (F. Aldemdorff, Germany.) (Complete.)

28,292. "Regulating-devices for electric motors." W. G. Haywood. December 8th.

28,338. "Accumulators." H. W. van Raden. December 9th.

28,355. "Apparatus for heating liquids electrically." British Electric Heater Co., Ltd., and C. Kratt. December 9th.

28,369. "Means for the production of sparks according to Wien's method." Dr. E. F. Huth G.m.b.H. December 9th. (Convention date, December 27th, 1912, Germany.) (Complete.)

28,376. "Telephone relays and the like." W. Aitken. December 9th.

28,409. "Wireless telegraphy." F. G. Sargent. December 9th. (Complete.)

28,413. "Receivers for use in wireless telegraphy." Marconi's Wireless Telegraph Co., Ltd., and H. J. Round. December 9th.

28,415. "Apparatus for the production of electricity for use in the treatment of birds and animals." T. T. Baker. December 9th.

28,421. "Electric-lamp fixtures." R. Doi. December 9th. (Complete.)

28,423. "Machines for making fibre tubes." C. Mehlum. December 9th. (Convention date, December 26th, 1912, United States.) (Complete.)

28,444. "Process for the manufacture, isolation, and enrichment of radium and other radio-active substances. E. Ebler. December 9th. (Addition to 2,155/12. Convention date, December 11th, 1912, Germany.) (Complete.)

28,445. "Process for treating ores of radium, mesothorium, thorium, and other radio-active substances." E. Ebler. December 9th. (Convention date, February 27th, 1913, Germany.) (Complete.)

28,499. "Electric switch and gas-cock combined." E. Plumstead. December 10th.

28,502. "Switching apparatus for inter-connecting telephone lines by electro-mechanically-controlled switches." F. Aldendorff. December 10th. (Complete.)

28,527. "Electrical systems and switch mechanism therefor." R. Amberton. December 10th.

28,535. "Current-interrupting devices for electric igniting-apparatus used in internal combustion engines." P. Schroter. December 10th. (Convention date, December 11th, 1912, Germany.) (Complete.)

28,546. "Method of carrying out chemical reactions by means of ultra-violet rays." Jacoviello Soc. Anon. and J. von Kowalski-Wierusz. December 10th. (Convention date, December 11th, 1912, Germany.) (Complete.)

28,558. "Electrical accumulators or secondary batteries." H. W. van Raden. December 11th. (Addition to 25,727/13.)

28,559. "Telegraph tape transmitter." D. Murray. December 11th.

28,560. "Telegraph printer." D. Murray. December 11th.

28,578. "Enumeration of telephone calls." S. D. Williams. December 11th.

28,602. "Wireless telegraphy." E. C. Hoegerstaedt and H. S. Wescott. December 11th.

28,630. "Electrolytic converter for the transformation of alternating currents into continuous currents." A. Heinz. December 11th. (Convention date, January 21st, 1913, France.) (Complete.)

28,633. "Switching-devices for electric installations." Siemens Bros. Dynamo Works, Ltd. December 11th. (Siemens-Schuckertwerke G.m.b.H., Germany.) (Complete.)

28,634. "Electric fuses for blasting purposes." Bickford-Smith & Co., Ltd., and W. N. Bickford-Smith. December 11th. (Complete.)

28,703. "Automatic control system for electric railways." B. F. Hutches. December 12th. (Complete.)

28,715. "Arrangements for destroying residual magnetism." Fried. Krupp Akt. Ges. December 12th. (Convention date, January 10th, 1913, Germany.) (Complete.)

28,734. "Galvanic cells." J. Zaruba & Co. December 12th. (Convention date, December 13th, 1912, Germany.) (Complete.)

28,746. "Terminal pieces and contacts for electric circuit interrupters." F. B. Holt. December 12th.

28,755. "Device adapted to intensify current impulses in telegraphic and other signalling." W. E. Evans. December 12th. (M. N. K. B. M. Johansen, China.)

28,757. "Manufacture of radio-active preparations." Radiogen-Ges. December 12th. (Convention date, December 13th, 1912, Germany.) (Complete.)

28,802. "Switching apparatus for telephone systems." Western Electric Co., Ltd. December 13th. (F. T. Woodward, Belgium.) (Complete.)

28,822. "Arrangements for setting apparatus from a distance by electricity." Siemens Bros. & Co., Ltd. December 13th. (Siemens and Halske Akt. Ges., Germany.) (Complete.)

28,823. "Electric condensers." A. G. Bloxam. December 13th. (Robert Bosch (Firm of), Germany.) (Complete.)

28,824. "Containing-vessel for a granular mass of which the electric resistance is varied by pressure." Robert Bosch (Firm of.) December 13th. (Convention date, January 9th, 1913, Germany.) (Complete.)

28,826. "Alternating-current electric meters of the induction type." British Thomson-Houston Co., Ltd., and A. P. Young. December 13th.

28,829. "Transmitting apparatus for use with wireless telegraph or submarine sound signalling systems." W. H. Shephard and A. E. McKechnie. December 13th.

28,833. "Method of inter-connecting lines by electro-mechanically controlled switches." H. Baron. December 13th. (Fritz Aldendorff, Germany.)

28,838. "Telephone or like instruments." W. H. Derriman. December 13th. (Automatic Enunciator Co., United States.) (Complete.)

28,839. "High frequency electric current generators." P. O. Pedersen. December 13th. (Convention date, December 19th, 1912, Denmark.) (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

21,209. Gas or Electrically Heated Wash-boilers, Boiling-pan, and the like. L. Schofield. September 18th. (March 18th, 1913.)

23,429. Composite Material suitable for use in the Construction of Heating Elements, Rheostats, and the like. A. C. Whish. October 14th.

26,499. Automatic Telephonic Apparatus. B. Degenhardt. November 18th. (November 18th, 1911. Patent of Addition not granted.)

26,548. Incandescence Filament Lamps. J. R. Quain. November 19th.

26,603. Self-starting Device for Motor-car and Marine Engines and the like. S. B. Seropian. November 20th.

26,752. Methods of and Apparatus for Charging Storage Batteries. D. H. Wilson. November 21st. (Convention date not granted.)

26,953. Electric Conduit Junction Boxes or like Electric Fittings. F. H. Terry, H. M. Bigwood and Brotherton Tubes & Conduits Ltd. November 23rd. (Patent of Addition not granted.)

27,312. Electrical Devices for the Distant Transmission of Positions. British Thomson-Houston Co. Allgemeine Elektricitäts Ges. November 27th

29,176. Electric Compressors. E. Morisot. December 18th.

29,268. Obtaining of Uni-directional High Tension Discharges. Sir O. J. Lodge and L. Lodge. December 19th.

29,597. Lamps for Ophthalmoscopic and Larynoscopic purposes. E. M. Wyche. December 23rd. (Cognate Application, 378/13.)

1913.

79. Electrical Terminals. S. W. Martyn. January 1st.

1,286. Shade or Globe Carrier for use with Electric Lamp-holders. M. J. Railing and G. Maurice. January 16th.

1,471. Electric Contacts. F. M. Mildey. January 18th. (Cognate Application, 4,383/13.)

2,577. Electric Furnace with Electrodes Passing through Charging Receptacles. A. Helfenstein. January 31st. (February 4th, 1912.)

3,335. Alarm Apparatus for the Protection of Conduits of all kinds, and especially of Electric Mains. A. L. Pucel. February 8th. (February 14th, 1912.)

3,864. Electric Heating and Lighting Devices. A. C. Michie & Sir R. A. S. Paget. February 14th.

3,987. Switching Arrangements for Automobile Lamps. M. S. Conner. February 17th.

5,173. Magazine Arc Lamps. A. E. Spencer, & Johnson & Phillips, Ltd. March 1st.

6,192. Wireless Clock-synchronising Apparatus. R. L. Roze des Ordons. March 12th. (March 13th, 1912.)

6,359. Lightning Arrestors. G. Giles. March 14th.

6,700. Miners' Electric Safety Lamps. P. Wolf. March 18th.

6,965. Arc Lamp Globes. S. L. Pearce and A. Wilkinson. March 22nd.

9,169. Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.) April 18th.

9,264. Mounting of Carbon Brush Holders of Magneto-electric Ignition or other Machines. Robert Bosch (Firm of.) April 19th. (February 22nd, 1913.)

9,590. Enclosed Electric Furnace with Upper Charging Chutes. Helfenstein Elektro-Ofen-Ges. April 23rd. (April 27th, 1912.)

10,556. Telephone Fixtures. W. C. Ude. May 5th. (May 3rd, 1912.)

10,900. Automatic Electric Alarms, Signals, and the like. P. Dunne. May 8th.

11,430. Rotary Magnetic Separators. E. C. R. Marks (Maschinenbau-Anstalt Humbolt.) May 16th.

12,061. Circuit Arrangements for Telephone Systems. Siemens & Halske Akt. Ges. May 23rd. (May 25th, 1912.)

15,116. Reflectors. F. Holland. July 1st.

15,566. Electric Radial Selector Switches. Sterling Telephone and Electric Co., and W. Allcock. July 5th.

17,725. Dynamo-electrical Machines. D. H. Andrews and E. C. Ketchum. August 1st.

17,925. Electrodes for Electric Furnaces. Fried. Krupp Akt. Ges. August 6th. (September 18th, 1912.)

19,928. Circuit Arrangements for Telephone Systems. Siemens & Halske Akt. Ges. September 3rd. (September 11th, 1912.)

19,939. Transmitter Devices for Copying and like Telegraphic Apparatus. A. Rappenecker. September 3rd.

20,822. Multiple Telephony. H. Tietgen. September 15th.

Electric Smelting of Iron Ore.—The Swedish engineer, Director A. Grönwall, applied some time ago to the Swedish Government, for a mining concession in connection with the erection of a large electrical iron works at Küruna, in the north of Sweden. This application was approved by the mining inspector of the district. The iron ore for the projected new works will be extracted from the well-known Luossovare Mines, which are under the control of the Grängesberg Co. until 1932, when the mines will be taken over by the State, provided that the existing contract is not prolonged. The production of the new works has been estimated at 25,000 tons of pig iron per annum, for which there will be required 8,500 E.H.P. The energy will be derived from the Porjus Electrical Works, which have been erected by the State in connection with the electrification of the railway from Küruna to the Norwegian frontier. After the regulation of the river and the harnessing of the Porjus Waterfalls it was found that the supply of water, and consequently the available energy, was much larger than was anticipated, and it will thus be possible to produce energy in excess of the amount required by the railway at a very low cost. The estimates for the new electrical works are based on a cost of energy of 35s. 2d. per H.P.-year.

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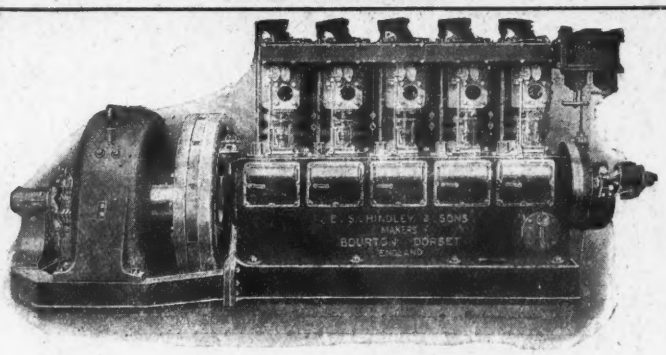

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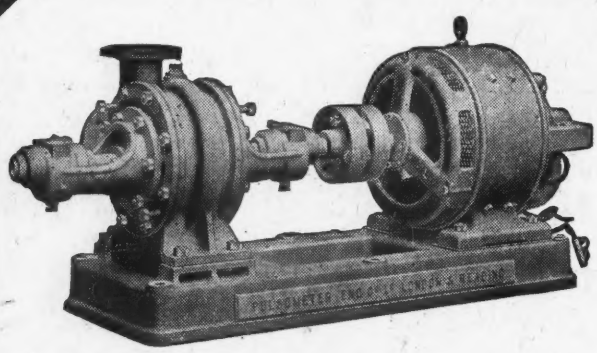

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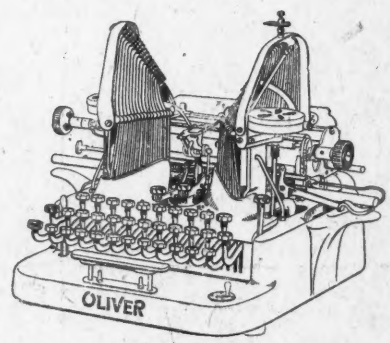

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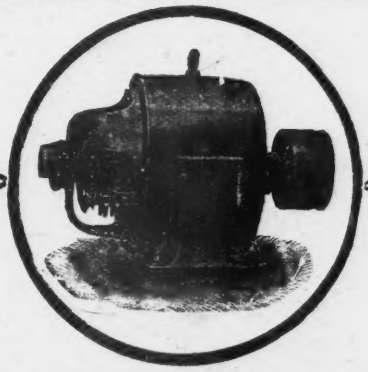

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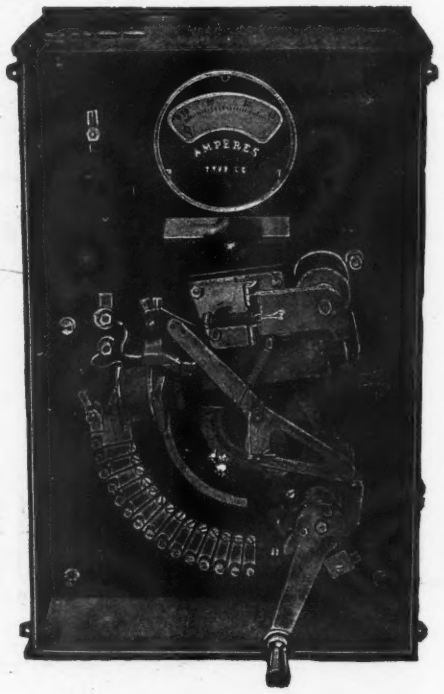

1st Operation closes D.P. Circuit-Breaker and so closes the circuit.
2nd puts Switch on first stop of starter.
3rd racks up one tooth only.
4th Ditto, &c.

Note. ***Switch cannot be left in any intermediate position for the switch will not hold in until it is held by no load coil. Breakers are free to operate in any position of starter.***

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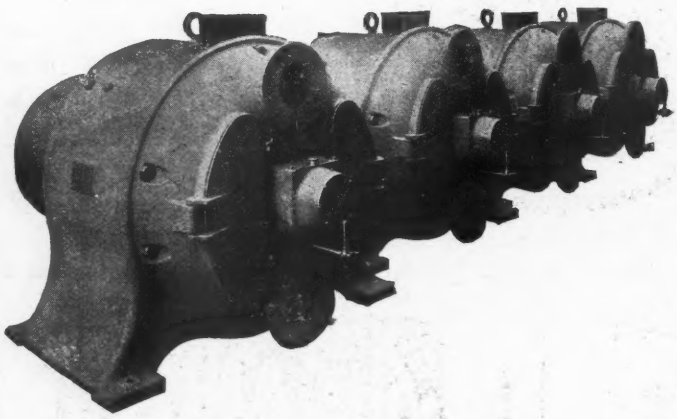

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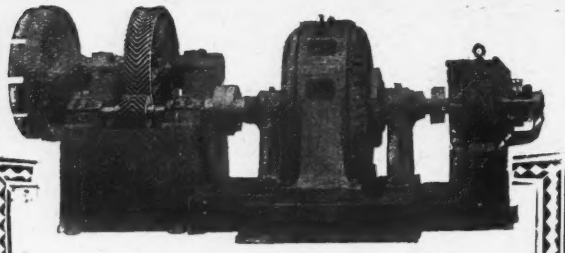

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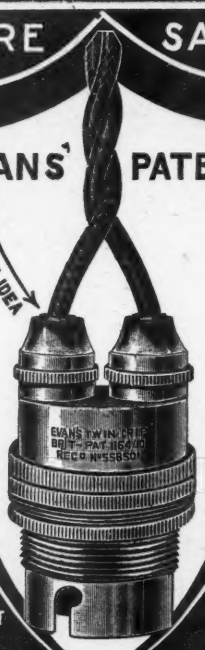

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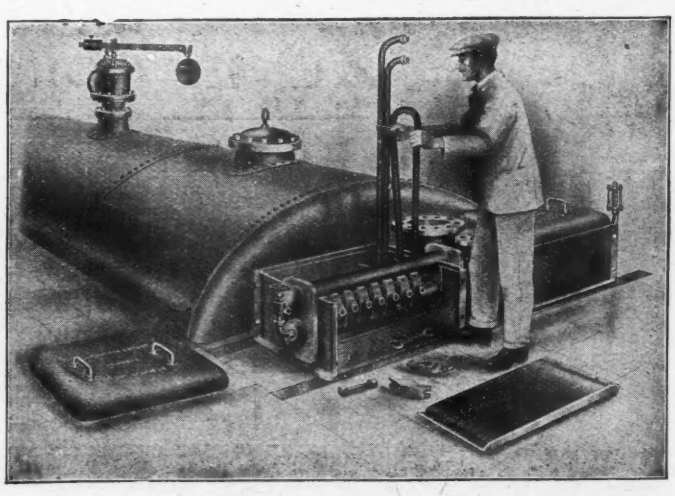

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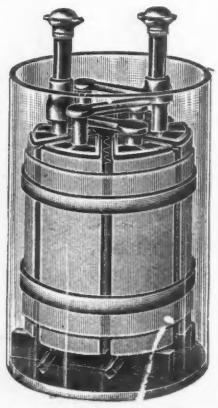

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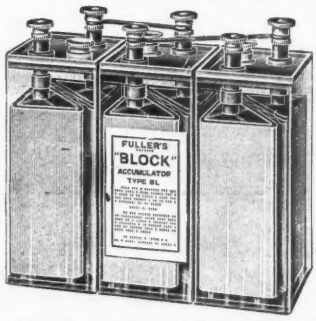

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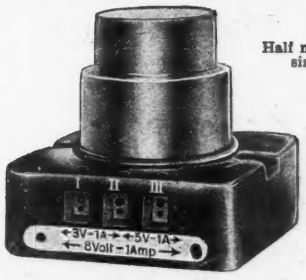

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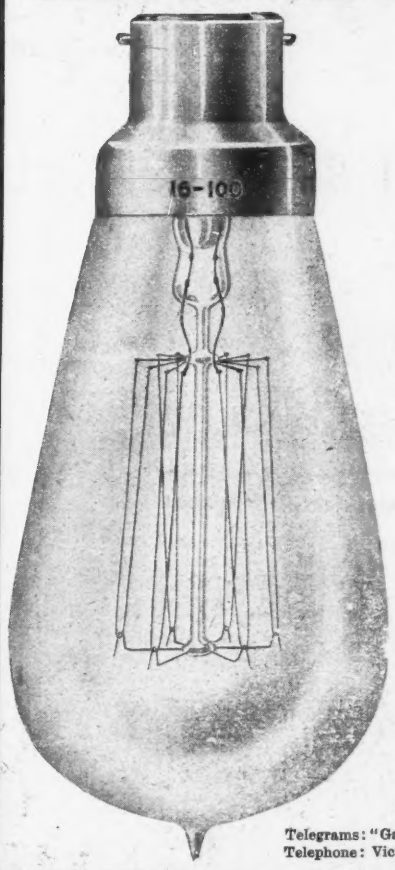

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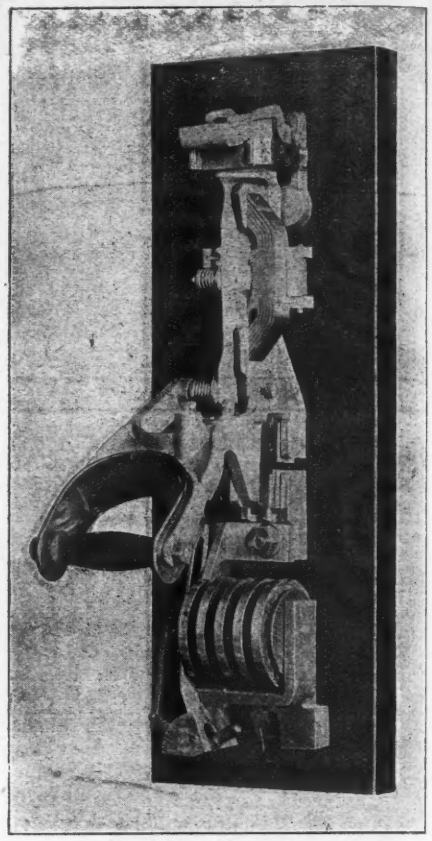

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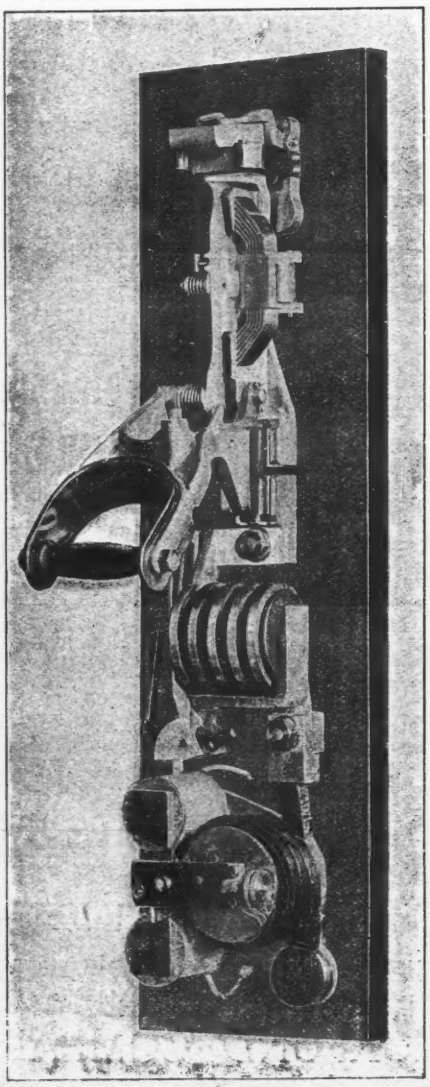

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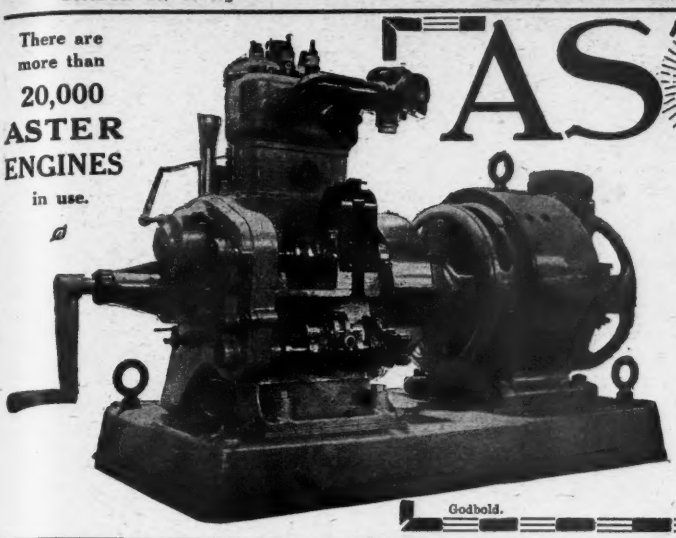

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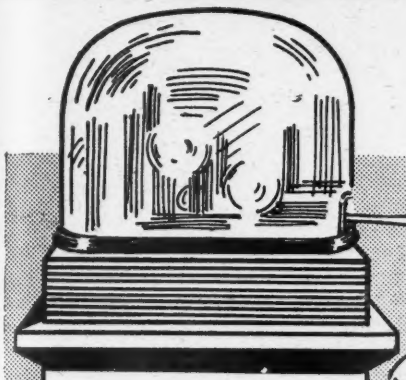

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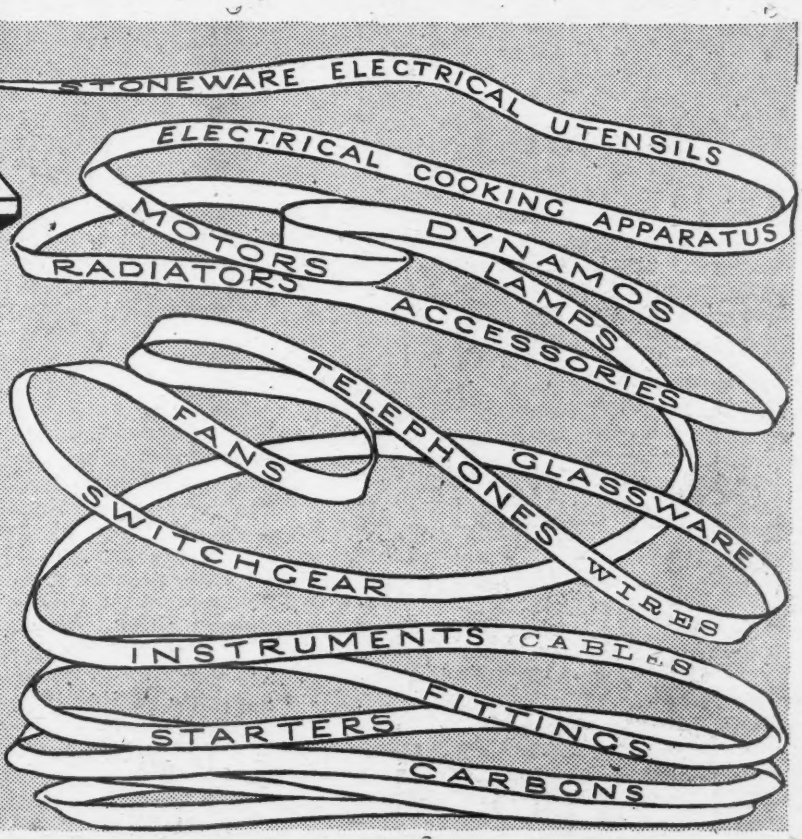

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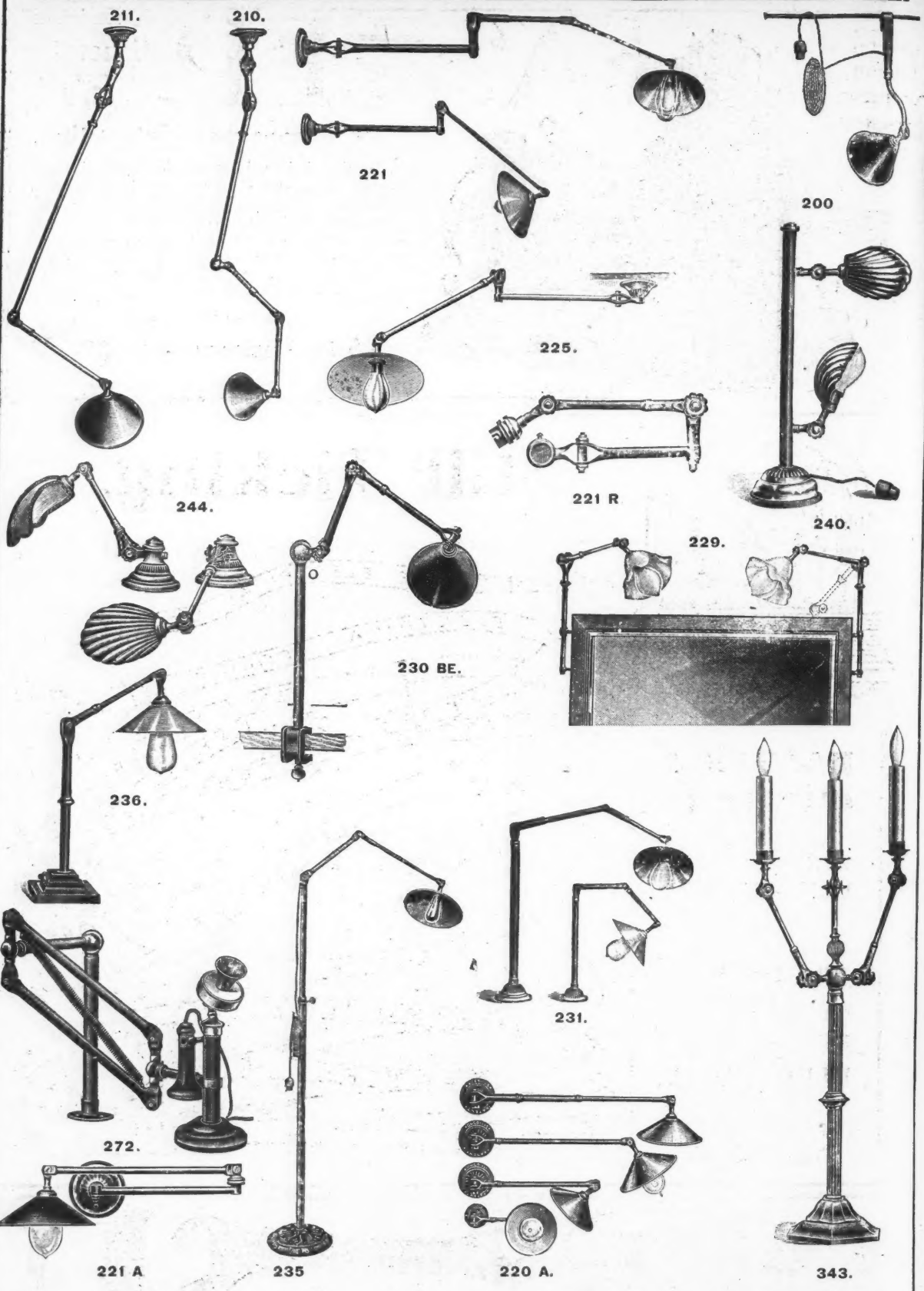

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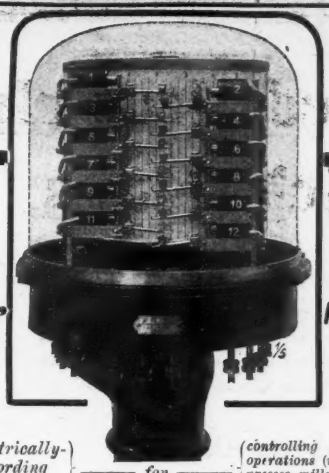

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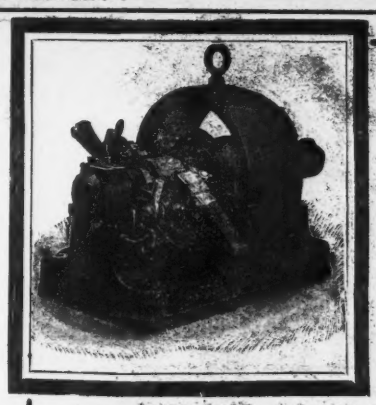

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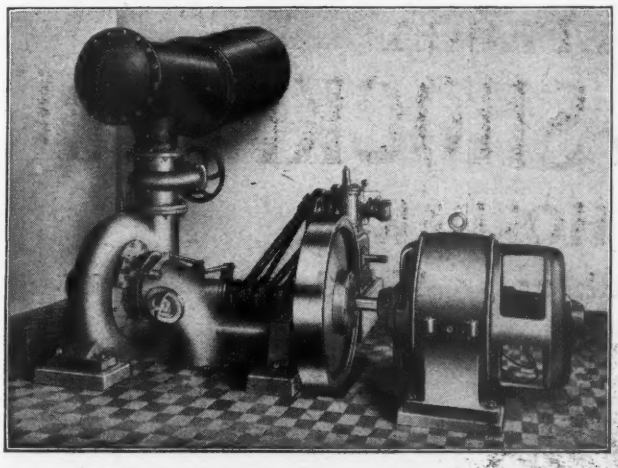

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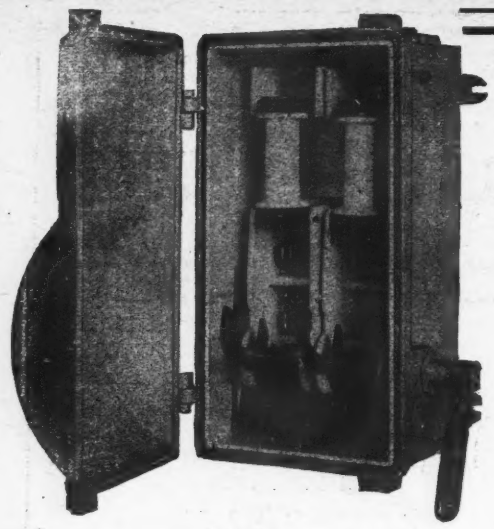

Fig. 546.

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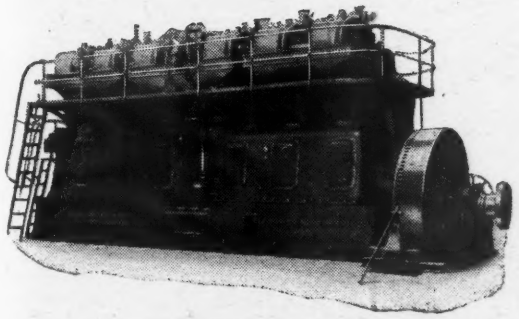

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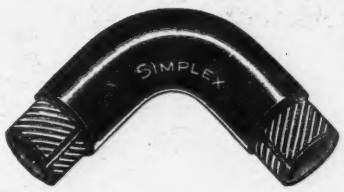

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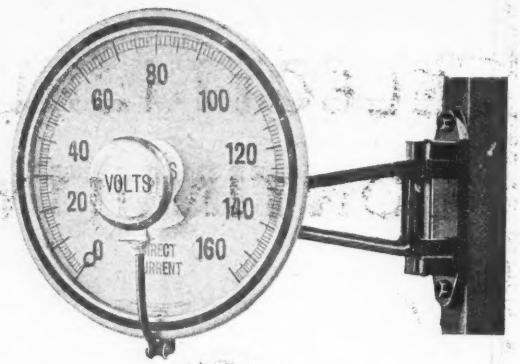

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"CIRSCALE"

36" SCALE

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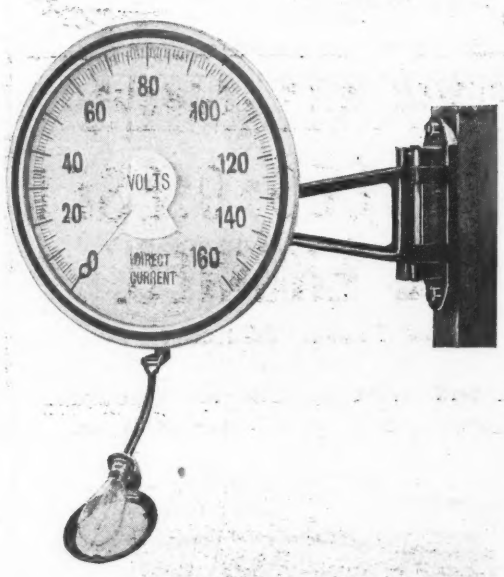

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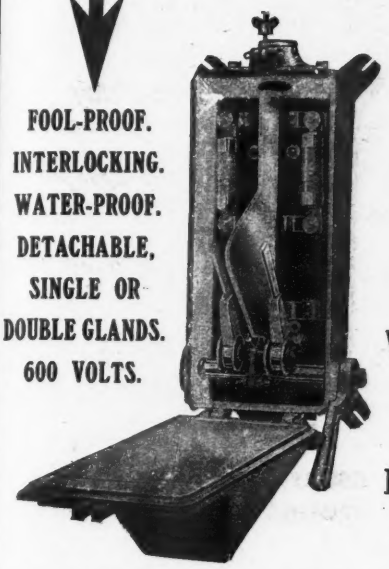

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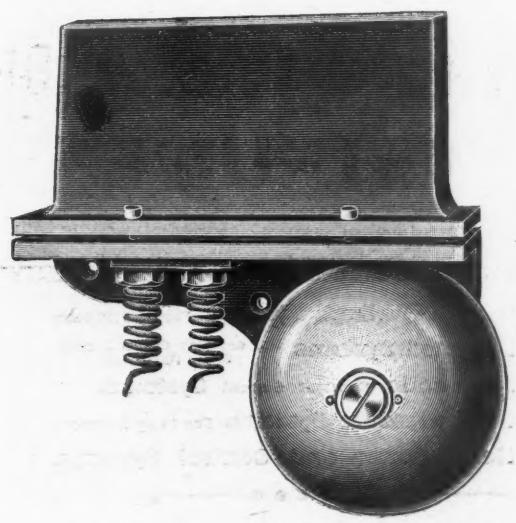

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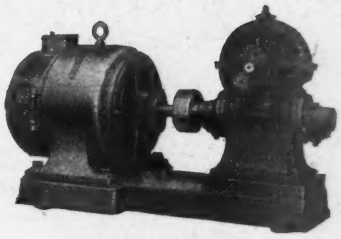

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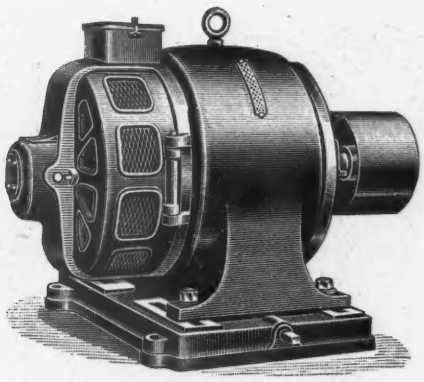

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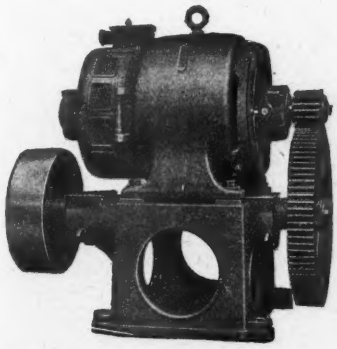

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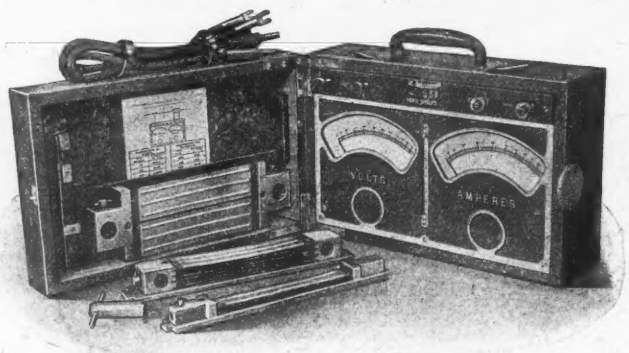

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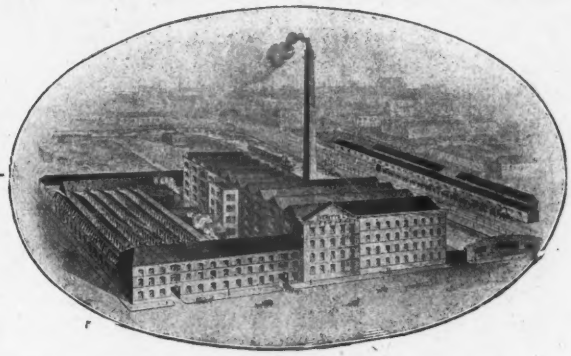

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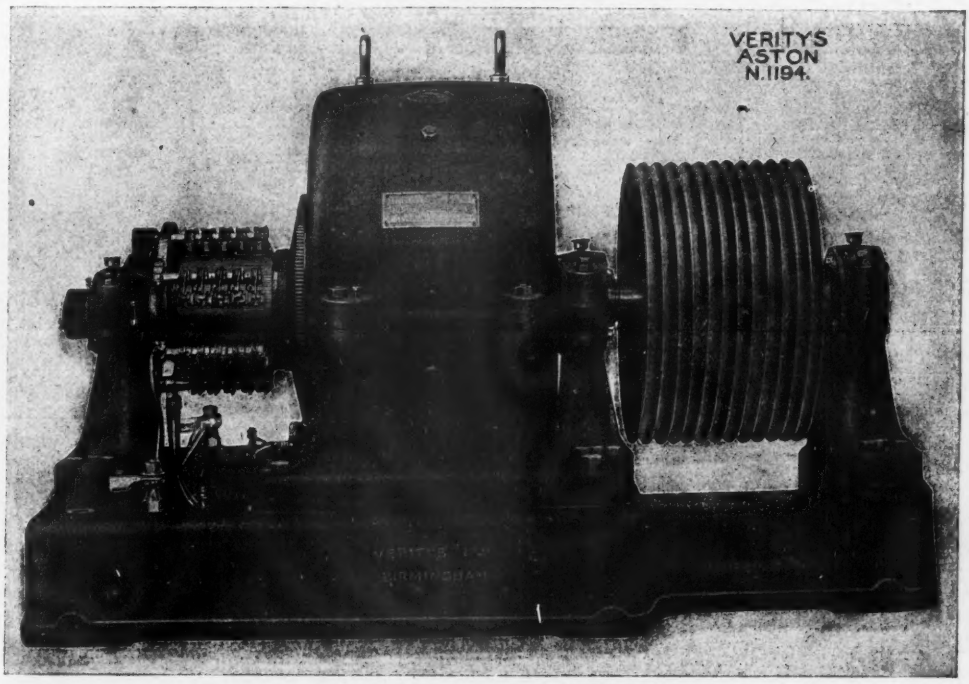

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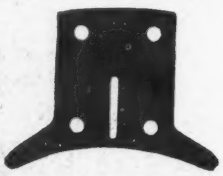

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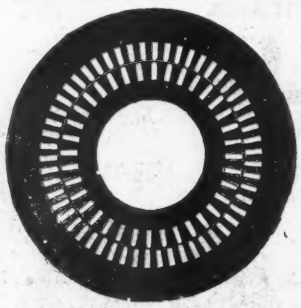

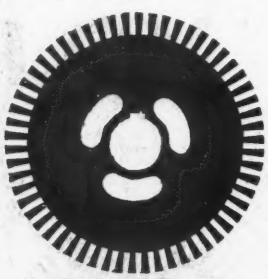

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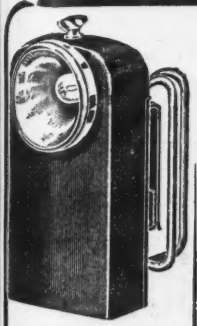

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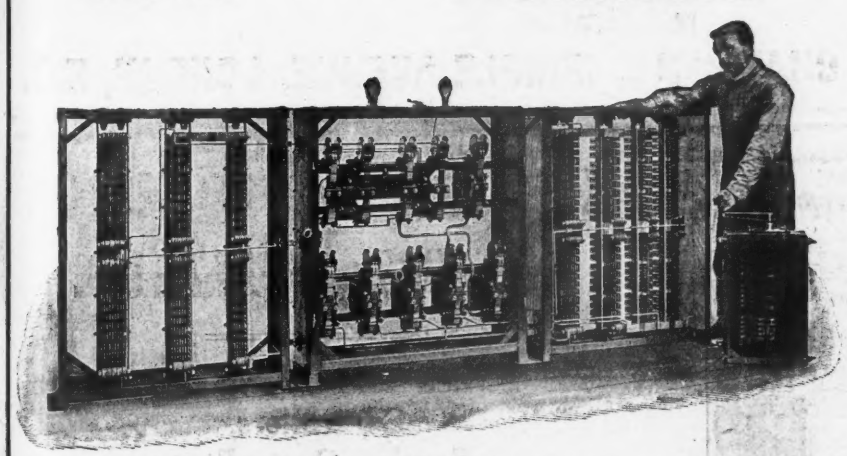

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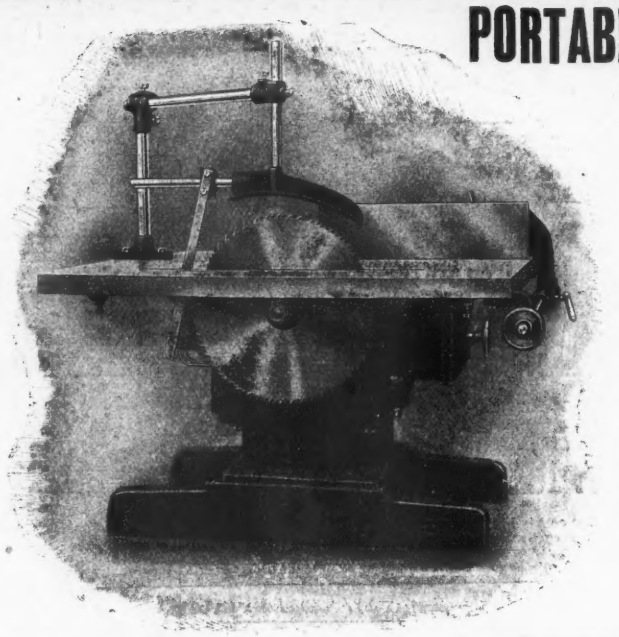

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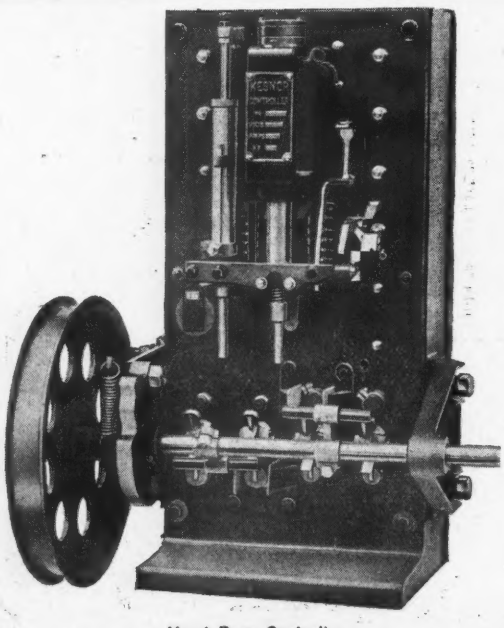

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Size 1 ...	19 × 12 ins. ...	33 × 15 ins.
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,, 1b ...	21 × 12 ins. ...	33 × 17 ins.
,, 2 ...	21 × 14 ins. ...	33 × 17 ins.
,, 2a ...	21 × 16 ins. ...	33 × 17 ins.
,, 2c ...	21 × 18 ins. ...	33 × 17 ins.
,, 2b ...	25 × 14 ins. ...	36 × 21 ins.
,, 3 ...	25 × 16 ins. ...	36 × 21 ins.
,, 3a ...	25 × 20 ins. ...	36 × 21 ins.
,, 3b ...	31 × 16 ins. ...	36 × 27 ins.
,, 4 ...	31 × 20 ins. ...	36 × 27 ins.
,, 5 ...	36 × 24 ins. ...	42 × 33 ins.
,, 6 ...	42 × 24 ins. ...	62 × 38 ins.
,, 7 ...	36 × 30 ins. ...	46 × 30 ins.
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,, 9 ...	36 × 36 ins. ...	42 × 33 ins.
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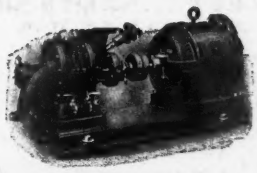

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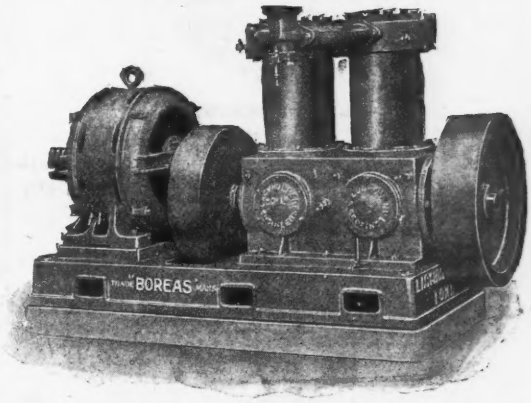

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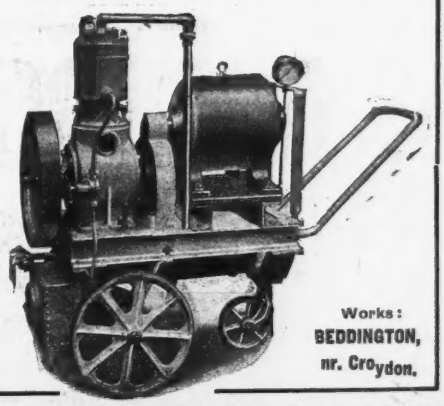

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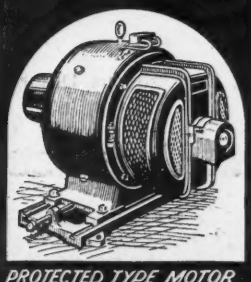

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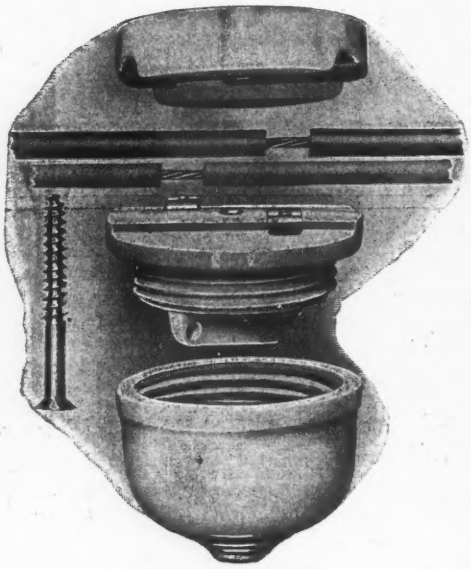

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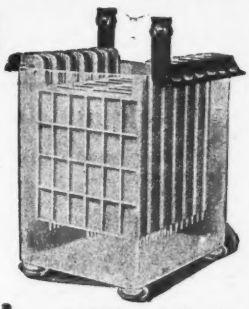

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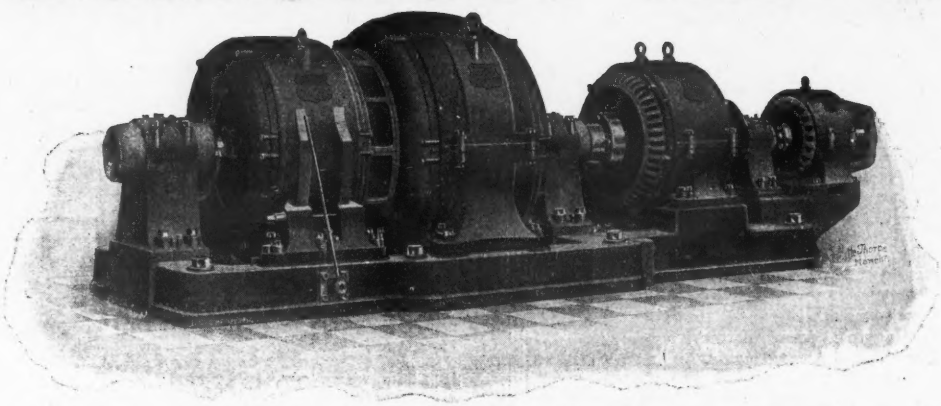

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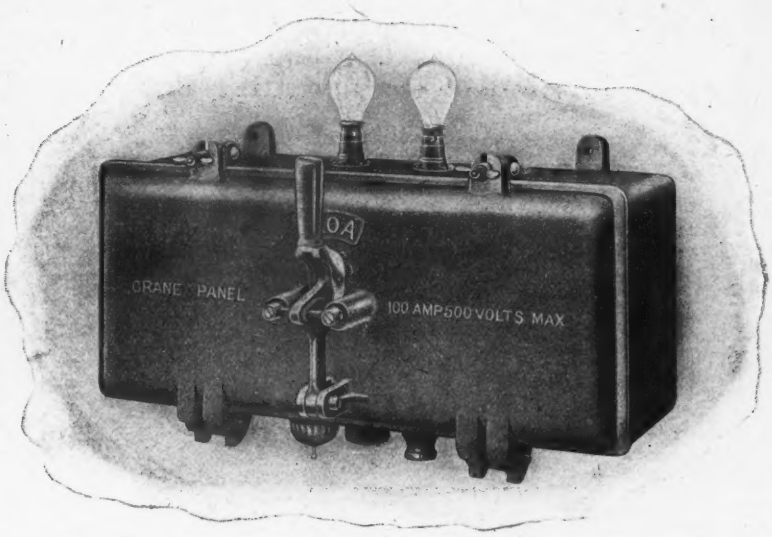

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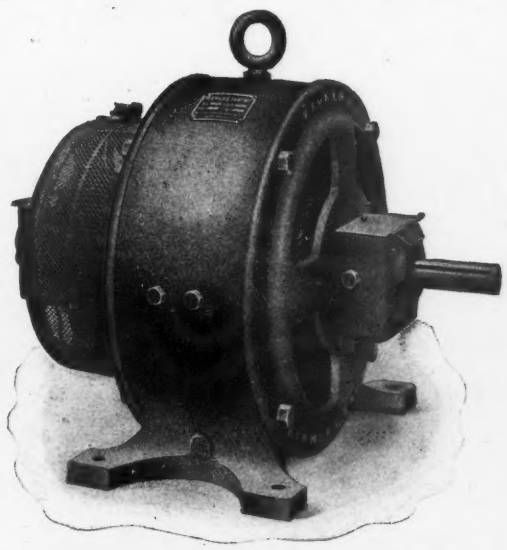

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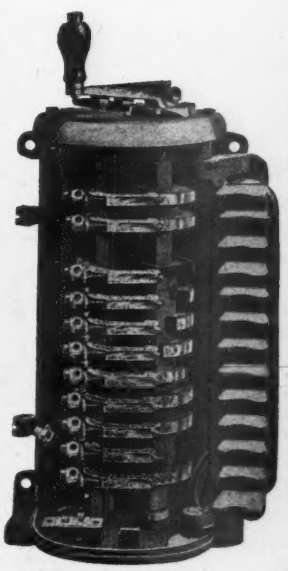

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Quote M/6541 on letter on application. 8784

(*Continued on next page.*)

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ASSISTANT Electrician for collieries in Lancashire, applicant must state experience with three-phase, wiring and telephones. Copies of two testimonials. Wages 6s. per day, extra for overtime.—8811, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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DRAUGHTSMAN, to be thoroughly experienced in electric lifts.—Apply, WM. WADSWORTH & SONS, LTD., Thynne Street, Bolton. 8809

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ELECTRICIAN, first-class man, wanted in London, S.E.; must be used to lift work and fitting up electrical parts of same.—Write, stating age, experience and wages required, 8797, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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EXPERIENCED Electrical Wireman wanted for all classes of work. Apply stating age, experience and wages required, VICKERS, LTD., Labour Bureau, Barrow-in-Furness. 8802

FIRST-Class Wiremen wanted, used to all systems and plant.—BOSHER, Electrical Engineer, Aberdare. 2855

INSTALLER (telephone) wanted, first-class man capable of taking full charge of exchange installation work. Good prospects for the right man. East London district.—Write stating age, present salary and experience, to 2842, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

JUNIOR Shift Engineer required to take charge of combined traction and lighting plant. A thorough knowledge of alternate current working essential, and preference will be given to one having also an experience of tramway generating plant with battery and booster. Commencing salary £78 per annum with annual increments. Applications, stating age and enclosing copies of recent testimonials, to be addressed to the BOROUGH ELECTRICAL ENGINEER, Electricity Works, Dover, not later than Saturday, January 3rd. 8800

JUNIOR Shift Engineer wanted. Three-wire lighting and traction station. One with workshop experience preferred. Salary 25s. per week; early increase to suitable man. State age and experience. — 8799, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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PYROMETER Salesman required; must be a practical man, capable of installing and checking outfits, and advising prospective customers. — Reply, stating experience and salary required, to ROBT. W. PAUL, Newton Avenue Works, New Southgate, London, N. 2783

(Continued on next page.)

SITUATIONS VACANT.—*Continued.*

SHIFT Engineer. Experience in direct current, three-wire station essential. Wages 30s. per week of seven 8-hour shifts. Cable Jointer. Experienced with low-tension paper cables, &c., for three-wire distribution. Wages 35s. weekly.—Apply in both cases immediately to W. H. MILLER, Engineer and Manager, Electricity Works, Fleetwood. 2882

SWITCHBOARD Attendant wanted for an alternating and direct-current station. Wages 30s. to commence.—Apply stating age, with copies of testimonials, to STATION SUPT., The Mersey Power Co., Weston Point Power Station, Runcorn. 2815

SWITCHBOARD Attendants wanted for the L.C.C. Tramways Sub-stations. Shift duties. Wages 30s., rising to 40s. a week. Applicants must have practical knowledge of switchboard operation, and be not less than 22 years of age.—Apply to the CHIEF OFFICER, L.C.C. Tramways, 62, Finsbury Pavement, E.C. 8730

SWITCHBOARD Inspector (telephone), wanted young man with good experience of testing out C.B. and magneto boards, East London district.—Write stating age, experience and salary required, to 2841, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TELEPHONE Engineers.—Wanted, energetic Juniors for work on automatic and manual exchange equipments; experience in exchange work desirable. Salary according to capabilities.—8794, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TEST-Room Assistant required for Cable Factory in Lancashire. Apply stating experience and salary required, to 8732, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TEST-Room Assistant required for cable works near London. Knowledge of logarithms essential.—Apply stating age and salary expected, 8807, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TRAVELLER wanted to canvass for sale of lamps and contracting work.—State age, experience, &c., 2878, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED immediately, young Man (19-20) as Clerk (shorthand and typewriting), smart and accurate at figures, for tramway and electric lighting company in Midlands.—Apply in writing, with copies of testimonials, to 8790, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED for St. Petersburg, by an English firm of electrical contractors, a first-class experienced leading Wireman, thoroughly capable and used to setting out and erecting best class steel conduit work, and with thorough knowledge of erecting small dynamo sets for country mansions, &c.; also several Wiremen.—State experience, salary required and all conditions, to 8652, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Chief Inspector for finished instruments and apparatus of telephone factory. Must have had good technical training and experience in the inspection of instruments of a varied character.—Apply stating age, experience, and salary required, to THE STERLING TELEPHONE AND ELECTRIC CO., Sterling Works, Dagenham, Essex. 8801

WANTED, Estimating Clerk for Telephone Firm in North London. Thorough knowledge of telephones and feeble current apparatus essential.—Age, salary, experience to 8803, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WORKS Order Clerk required by large electrical engineers, Midlands; must be quick, accurate and energetic. One with shop experience of mechanical parts—controllers, switchgear and motors—preferred. State age, experience and salary required.—8787, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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HUDDERSFIELD and District.—Public Electric Supply and Private Electrical Plant Engineers are invited to an open general meeting of the Association of Electrical Station Engineers at the Pack Horse Hotel, Kirkgate, Huddersfield, Thursday, January 8th, at 8 p.m. 2884

SITUATIONS VACANT.—*Continued.*

PLYMOUTH and Devonport.—All electrical engineers in this district please communicate at once with J. M. FISHLEY, Evelyn House, Evelyn Place, Plymouth, who is organising a branch of the A.E.S.E.—Particulars of the Association from W. J. EBBEN, Hon. Secretary, 7, Vernon Road, Stratford, London, E. 2885

If letters are not to be delivered to certain firms or individuals (if known), instructions to that effect should be sent to the Manager of the ELECTRICAL REVIEW, who will do his best to carry out such instructions. Letters of applicants cannot in such cases be returned to them, nor can the names of Advertisers using a number in any way be disclosed.

APPOINTMENTS FILLED.

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BOX 8533.—Applicants for post of Electrician are thanked, and informed that the vacancy has now been filled. 8788

BOX No. 8584.—Station Engineer.—Applicants are thanked and hereby informed that the position is now filled. 8812

ELECTRICITY Works, Redditch. — Improvers as Switchboard Attendants.—Applicants for these positions are thanked, and informed that these vacancies are now filled. 2887

ELECTRICITY Works, Redditch.—Jointer.—Applicants for this position are thanked, and informed that the vacancy is now filled. 2886

SWITCHBOARD Attendant, Chiswick Electricity Works. Candidates are thanked for their applications. The vacancy has now been filled.—ENGINEER, 93, High Road, Chiswick. 2883

SITUATIONS WANTED.

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ARMATURE Winder and Fitter requires situation abroad.—S. J., 40, East Street, Charlton, Woolwich. 2808

ACCOUNTANT.—Advertiser is Chief Accountant to an Electric Light and Power Undertaking abroad, and, for domestic reasons, wishes to return to the Old Country. Has had a first-class experience in all phases of accounting both at home and abroad. Can produce exceptional qualifications and references. Character unquestionable. Bond in any amount. Total abstainer. Age 33. In best health; hard worker. Results produced. Reasonable offer accepted.—2832, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CONTRACTOR'S Foreman (30), experienced large installations, estimate; could represent. Excellent references. Home or abroad.—2836, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL and Mechanical Engineer with extensive commercial and technical experience, English and Continental, and highest references and qualifications, desires position as Engineer-Salesman, Works Engineer, or Agent; Lancashire district preferred for a firm of good standing.—8715, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(*Continued on next page.*)

SITUATIONS WANTED.—*Continued.*

ELECTRICAL Engineer (30) desires responsible position, 12 years' experience in works and test-room management with leading instrument, telephone, controller and switchgear firms.—2868, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer desires change of position; 20 years' experience in the trade, especially in estimating for and carrying out large power stations for mines and collieries in England and abroad; also experience in electrical ship plants.—Please write to PRUGGMAYER, 48, Arden Road, Handsworth, Birmingham. 2803

ELECTRICIAN (24), dynamos, motors, winding, repairs and maintenance; London preferred.—B., 91, Bickley Street, Tooting, S.W. 2861

FOREMAN Electrician wants situation, A.C., D.C. power plants, steam turbos; power station experience; maintenance.—2805, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SWITCHBOARD Attendant or self-made Electrical Engineer (24) wants responsible p sition; eight years' practical experience in D.C. and A C. power houses. installation and maintenance of lighting and power plant; not afraid of men. Good references.—2876, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WIREMAN disengaged, all systems; rate 8½d.—H. A. GUNNER, 157, Ravenslea Road, Balham. 2880

WIREMAN-Assistant, 3 years' experience, seeks sit.—74, Muriel Street, Barnsbury. 2847

PARTNERSHIP.

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YOUNG Gentleman with capital, knowledge draughtsmanship and electricity, wanted to join Engineer of repute.—2817, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AGENCIES.

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ELECTRICAL Engineer, travelling Southern Counties, wishes to represent manufacturers of Instruments, Switchgear, Castings, Accessories; 12 years' experience in district; first-class connection; excellent references. Terms, commission and part expenses.—2777, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL or Allied Trades.—Do you wish any Apparatus or Novelty introduced into Scotland? I can create a demand for same. Advertiser is a qualified mechanical and electrical engineer.—2774, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

METAL-Filament Lamps.—Established firm of British Lamp Manufacturers, with high-class connection, require Agents in Bristol, Manchester, Liverpool, Glasgow, Dublin and Newcastle to sell non-conference lamps.—2851, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AGENCIES.—*Continued.*

WELL-known London Electrical Engineers and Manufacturers require first-class Agent in Glasgow to represent them for Cables, Accessories, Motors and Dynamos, &c., on commission basis only. Only firms with well-established connections need apply.—8793, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR SALE.

FOR SALE.

THREE 750-KW. Turbo-Generators, 440 volts, three-phase, with Condensers, or would sell Turbines and Condensers separately.
One 35-KW. Central Station Set (Brush), 2100 volts, single-phase, enclosed Corliss Engine.
,, 100-KW. Enclosed Set, 250 volts.
,, 75-KW. Enclosed Set, 110 volts.
,, 50-KW. Enclosed Set, 250-500 volts.
,, 30-KW. Generating Set, 110 volts, 250 revs.
,, 25-KW. Generating Set, 110 volts, 250 revs.
,, 20-KW. Dynamo. Carbon Brushes, 200 volts.
,, 30-H.P. Motor, 220 volts. Enclosed.
,, 3-H.P. Motor, 110 volts. Shunt wound.
,, 25-KW. Multipolar Dynamo, 110 volts, 250 revs.
Two 3-H.P. Series-Wound Motors, 100 volts.
Two 2-H.P. Series-Wound Motors, 100 volts.
We also have in stock Gas, Oil, and Steam Electric Lighting Engines.

HARRY H. GARDAM & CO., LTD., Staines. 8749

FOR SALE.

75-KW. Belliss-Westinghouse Electric Set, two-crank Comp. Engine, direct-coupled to 230-volt Generator.
Wheeler Condensing Plant, capacity about 15,000 lb. steam per hour.
Vertical Milling Machine, of the Plano Type (by Smith and Coventry). Tee slotted table 2 ft. 6 in. × 19 in.
36-in. D.G. Vertical Boring and Turning Mill (by Baush and Harris).
44-in. Swing Treble Geared-Face Plate Lathe (by Dean, Smith & Grace), with two tool rests on movable saddle.
9-in. D.G. Capstan Lathe (by Lodge & Davis), 2½-in. hollow spindle.
Two Gisholt Universal Tool Grinders.
No. 1 Bliss Automatic Armature Disc-Cutting Machine, for cutting discs up to 62-in. diam.
Nearly new High-Speed Disc Saw (by Roberts Bros.); 3-ft. saw.
No. 4 Brown & Sharpe D.G. Plain Milling Machine.

CATALOGUE of Stock MACHINERY. 2-3000 LOTS, free on application. Inspection invited.

THOS. W. WARD, LTD., ALBION WORKS,
Tel.: "Forward, Sheffield." SHEFFIELD.

GENERATING PLANT FOR SALE.

TWO Willans-Bruce Peebles three-phase Turbo-Alternators, each rated to give 1350 KW. at ·87 power factor as a continuous load. Frequency 50 cycles, speed 1500 R.P.M., voltage 6,600. The Turbines are of the reaction type and suitable for 200 lb. per sq. in. steam pressure, and are fitted with surface condensers, with necessary pumps.

One Parsons-Bruce Peebles Turbo-Alternator, exactly as described above.

These three are most reliable Machines and in excellent condition.

In addition, Two Parsons-Peebles Turbo-Alternators, exactly similar to the above, but would require general overhauling. Can be had at a great bargain. They could be converted into mixed pressure Turbines.

Four Condensers, by Cole, Marchant & Morley, each 20,000 lbs. steam per hour, 27¾ vacuum, with cooling 85° Fahr., together with electrically-driven Edwards Air Pumps and electrically-driven Tangye Centrifugal Pumps. The latter to deal with 1,200 gals. of water per minute, 35-ft. head.

Two Willans & Robinson High-speed Engines. Each Engine is fitted with three pairs of cylinders, 14 in. and 20½ in. diameter by 9 in. stroke. Speed 350 R.P.M., steam pressure 200 lbs. per sq. in., and is direct-coupled to one Bruce Peebles D.C. Generator, 190 KW., 550 volts, and to one 44-KW. 100 volts Generator, by the same makers, and are in perfect working condition.

Two 100-KW. Belliss-Crompton Compound Steam Generators, 150/160 lbs., 400 R.P.M., shunt-wound, 460/530 volts, compound-wound, 500/550 volts; also 50-KW. double-ended Generating Set, 550 R.P.M., shunt-wound, 230/260 volts.

Apply to:—R. H. LONGBOTHAM & CO., LTD.,
Ings Foundry, Wakefield.
Telegrams:—"Engineer, Wakefield." Telephone:—44 Wakefield.
8353

(Continued on next page.)

FOR SALE.—*Continued.*

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A.C. Motors, three-phase, 200·50, 5 H.P., one-phase, 200 85, 7½, 4, 2½ H.P., 200·60, 6 H.P., 400·50, 4 H.P., 100·50, 2 H.P. D.C. Motors 440 v., 10, 7½, 6, 2 H.P., 220 v., 10, 6, 5, 4, 3, ½ H.P.—WHITE, 140, Southwark Street. 8728

BLACKSMITH'S Forge, Eureka, by Allday & Onions, portable, collapsible, with Root's Blower; 70s., f.o.r.—SMITH, Ross Works, Bradford. 2679

CABLE Casings to compete against any manufacturers in the World. Trade discounts on application. Creosoted troughing and timber for underground work, also woodwork of all descriptions for home or export. Send 1s. 6d. for List and rule.—JENNINGS' Co., Timber Merchants, General Woodworkers, 991, Pennywell Road, Bristol. 7508

DYNAMOS, 3000, 1500, 1000 and 750 amperes at 6 volts, ready for delivery; also smaller sizes delivered from stock. Machines let out on hire.—CANNING & Co., Electro-Platers' Engineers, Birmingham.

EIGHTY Motors and Dynamos for Sale or Hire.—W. W. MARTIN, Witton Road, Birmingham. 2597

ELECTRIC Car, two-seater, £25.—C., 22, Rusper Road, Horsham. 2782

FOR Sale.—Electric Motors and Dynamos, Sale or Hire, always a large stock of nearly new machines; immediate delivery.—ELECTRO-GENERATOR Co., 1A, Shepherd's Bush Road, W. 'Phone 488 Hammersmith. 2838

FOR Sale. What offers?—One ¾-H.P. 210 v. Motor, by "Electromotors," coupled to worm gear; speed 32 R.P.M. Only two months' use. One ½-H.P. 210 v. Motor, by Blackman's.—GALTER BUTCHER, High Street, Winchester. 2865

FOR Sale, 450-KW. Generating Set, three-crank Triple-Expansion Engine, with Siemens D.C. 460-volt Multipolar Dynamo: now working.—WILLIAMS & SONS, 37, Queen Victoria Street, London. 8775

FOR Sale, 600-H.P. Vertical Triple-Expansion High-speed Engine; new 1903. Now fixed; a bargain.—WILLIAMS AND SONS, 37, Queen Victoria Street, London. 8776

FOR Sale, one superior Vertical High-speed Engine, enclosed type, 200 H.P., fitted with extended soleplate for carrying dynamo; cheap before removal.—5954, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, complete Electric Plant, comprising Rational 4½-H.P. Oil Engine direct coupled to Dynamo, Marble Switchboard, and 28 9-plate Cells; all in good condition.—Can be seen working by appointment to ENGINEER, "Charters," Ascot. 2881

FOR Sale, direct-current Motors, 200 a. 410 volts, ¼ to 80 horse, all of recent construction and in first-class order, complete with starters.—Full particulars, 2872, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, electrical 5-horse-power floor Lift by "Medway," 15 ft. 3 in. by 8 ft. 8 in. Has been very little used in motor garage; suitable for warehouse or works; in full working order.—Apply PLATTS, SON & MORGAN, York Chambers, Scarborough. 2786

FOR Sale or Hire, high-class Dynamos, Motors, Alternators, Cable and Arc Lamps.—PERCY HUDDLESTON & Co., 72, Finsbury Pavement, E.C. 2126

FOR SALE.—*Continued.*

FOR Sale, High-class Electric Plant, as under:—One 100-KW. Belliss-Morcom "Balancer" Electric Generating Set. 230 volts; also two 250-KW. Belliss-Morcom Generating Sets, 510 to 550 volts; all equal to new.—RIDDEL & Co., 40, St. Enoch Square, Glasgow. 8594

JOURNAL of the Institution of Electrical Engineers.—For Sale, Nos. 38, 52, 76, 77, 78, 80, 81, 83, 101, 102, 103, 120, 122, 123, 124, 125, 132, 133, 134, 135 and 136. Wanted Nos. 1, 3, 13, 14, 20, 29, 39, 44, 45, 46, 54 and 75.—H. SAVAGE, 77, Westcombe Park Road, Blackheath, S.E. 2828

NEW direct-current Siemens Motor, 25 H.P., 220 volts; Siemens Motor, 35 H.P., 220 volts; Parker Dynamo, 105 volts 150 amps.; two Parker Motors, 110 volts 1650 revs., 23 amps.; Parker Alternator, 400 volts, 21 5 amps., 50 periods, 6 H.P.; new Cables, 1/18, 3/22, 3/20, 7/18, 7/16, 7/14. All ridiculously cheap.—LAKE, 132, Upper Thames Street, London. 2785

SEARCHLIGHTS for Sale or Hire.—THE LONDON ELECTRIC FIRM, George Street, Croydon. 2879

STEAM-Electric Generating Sets for immediate sale; four 160-KW. Belliss-Siemens, 220/250 volts, engines two-crank compound; two 325-KW. Belliss-B.T.H., 220/250 volts, engines three-crank compound; one 150-KW. Willans-G.E.C., 500 volts; one 275-KW. Belliss-Sunderland Forge, 500 volts. Motors three-phase, 50 periods, 5/50 H.P., 500 volts and various others. List on application. All in guaranteed perfect working condition.—JENNINGS, West Walls, Newcastle-on-Tyne. 8019

TAUNTON Dynamo, 230 v. 220 amps., 680 R.P.M.; three 10-H.P. 220-v. motors.—MARTIN, Witton Road, Birmingham. 2823

VERTICAL Steam Engine, Single Cylinder, 7½-in. bore, 8-in. stroke, 120 R.P.M., fitted with patent expansion valve and governor; 6-H.P. Essex Boiler by Davey, Paxman, with 36 2-in. cross tubes; 1 D.C. Dynamo, 50 amps. 175 volts, 750 R.P.M.; spare Armature. Slate Switchboard, with 30-amp. charge and 60-amp. discharge ammeter, 200 voltmeter, Regulating Switches and D.P. Main Switches, Neville cut-out for 54 cells, 60 amps. All in good running order. The Plant may be seen on application to LANKESTER AND SON, LTD., 136, High Street, Southampton. 2830

ARTICLES WANTED.

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ACCUMULATORS, Second-hand, any type, wanted; also Dynamos and Machinery, Lead Peroxide, Old Copper Cable, Scrap Metals, and every description of Metallic Dross purchased for cash, town or country.—Write A. BROWN & SONS, 142, Lower Clapton Road, N.E. Telephone: Dalston 555. 6171

OLD Electric Lamp Tops, Cable and Wire bought for cash.—SMITH & Co., 2, Ranelagh Road, East Ham, London, E.

PLATINUM in any form and quantity, purchased at highest prices by DERBY & Co., LTD., 44, Clerkenwell Road, London.

PLATINUM, Old Electric Lamp Tops, Scrap Plat., purchased for cash; best price given.—S. W. PRICE & Co., Platinum Refiners, 13, Great Queen Street, Kingsway, London, W.C. 2831

WANTED, two open-type Arc Lamps, in working order, to run in series on 100 volts direct, 10-15 amps. Complete with resistances. State price.—2877, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(Continued on next page.)

ARTICLES WANTED.—*Continued.*

WANTED, Old Electric Lamp Tops, Scrap Platinum, Mercury, False Teeth, Metals, Rubber, Cables, &c.—Atlas Works, Umfreville Road, Harringay. 2873

MISCELLANEOUS.

WANTED, quotation for Cheapest Reliable Single-phase Lighting Meter for small installations.—MANAGER, Larne Electric Light Works, Ireland. 2833

ELECTRIC Lighting Sets for country houses, halls, yachts, &c. Economical and efficient, no skilled attention required. Specification and prices of standard types free on request. Estimates given for any requirements.—BOULTON & PAUL, LTD., Engineers, Norwich. 8144

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NOTICE.

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DONALD SMEATON MUNRO, M.I.E.E.

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I.	Introduction.	XI.	Screwed Tubing.	XX.	Procedure in Erection.
II.	Historical.	XII.	Metal-Sheathed Systems.	XXI.	Tests.
III.	Methods of Distribution.	XIII.	Concentric Systems.	XXII.	Faults and their Causes.
IV.	Wires and their Insulation.	XIV.	Outlet and Circuit Boxes.	XXIII.	Temporary and Portable Wiring.
V.	Joints and Trims.	XV.	Blocks, Grounds, and Fixings.	XXIV.	Mine Wiring.
VI.	Connectors and Looping.	XVI.	Accessories and Switching Arrangements.	XXV.	Ship Wiring.
VII.	Classification of Wiring Systems.	XVII.	Distributing Boards.	XXVI.	Fire and Life Risks.
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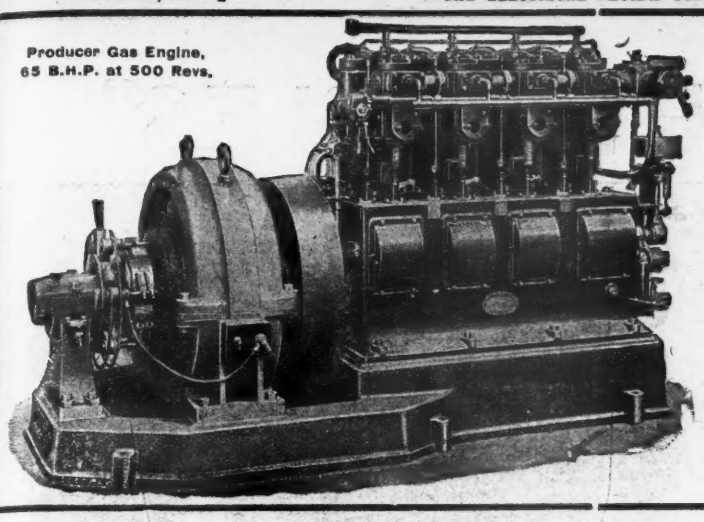
IX.	Wood Casing.				Index.

H. ALABASTER, GATEHOUSE & CO.,
4, LUDGATE HILL, LONDON, E.C.



Producer Gas Engine,
65 B.H.P. at 500 Revs.

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GARDNER

Gas and Oil Engines

Vertical High-Speed Type for coupling direct to Dynamos.

From 5 B.H.P. to 120 B.H P.

L. GARDNER & SONS, Ltd.,
Barton Hill Engine Works.
PATRICROFT, MANCHESTER.

NORRIS, HENTY & GARDNER'S, Ltd.,
87, Queen Victoria Street, London, E.C.
Telephone No. 9702 City.
Telegraphic Address: { NORNODENTE, CANNON, LONDON (charged as two words only).

Glasgow Showroom: **45, BOTHWELL ST.**

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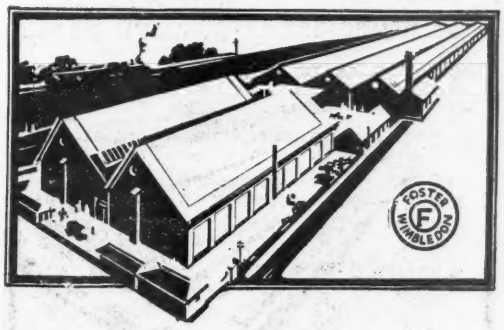
for dealing with
APPARENT DEATH
from Electric Shock should be in every Generating, Transforming and Motor House.
Mounted on Cardboard, 1s. each; postage 3d. extra.
4, LUDGATE HILL, LONDON, E.C.

Telephone—1290, 1291 *and* 170 *Wimbledon.* On ADMIRALTY, POST OFFICE, WAR OFFICE & LISTS

Telegrams. ABC Code 5th "Fosteraco". London.



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The highest efficiency is obtained with the FOSTER Transformer.

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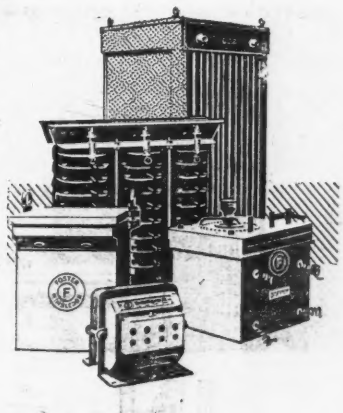

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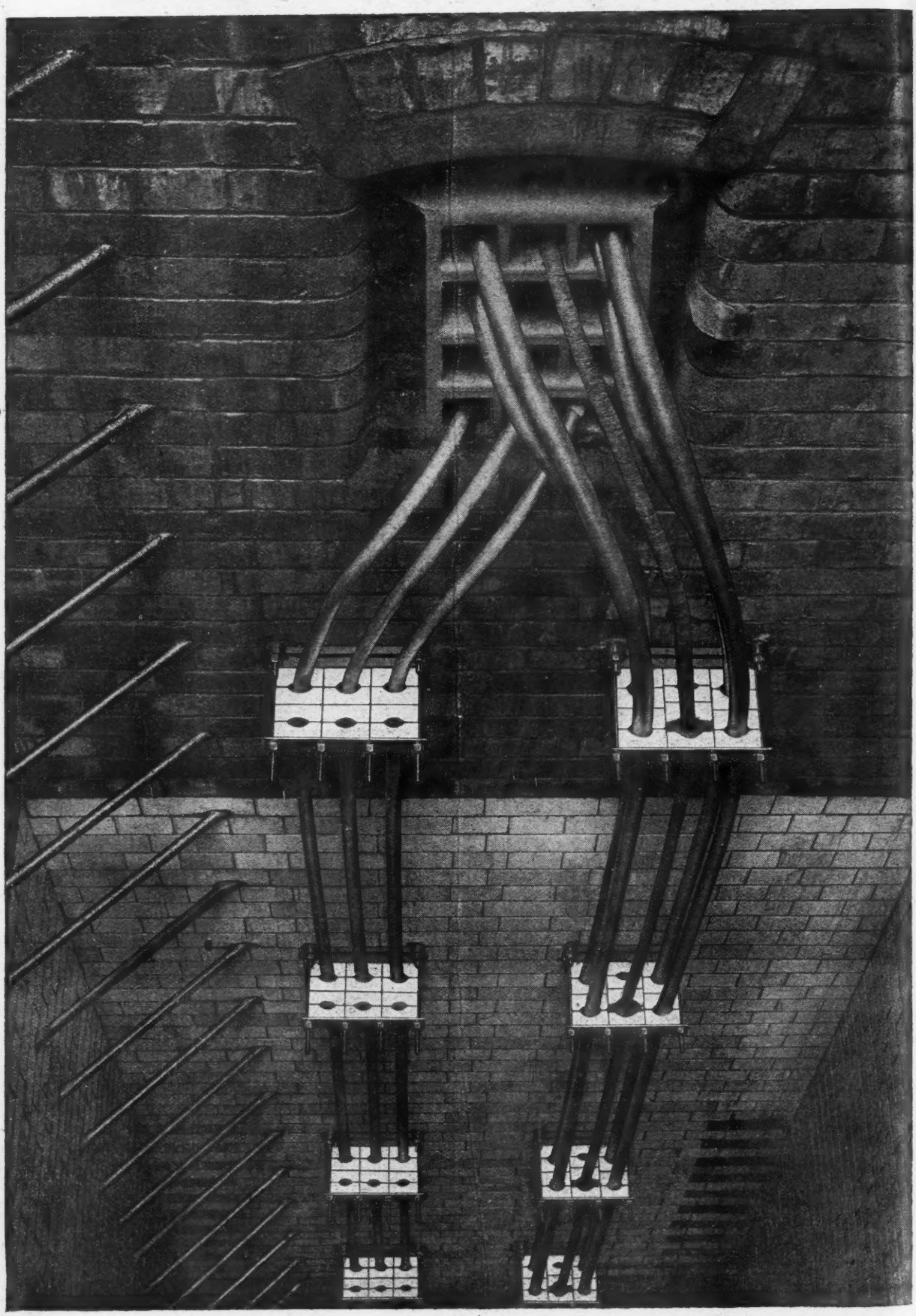

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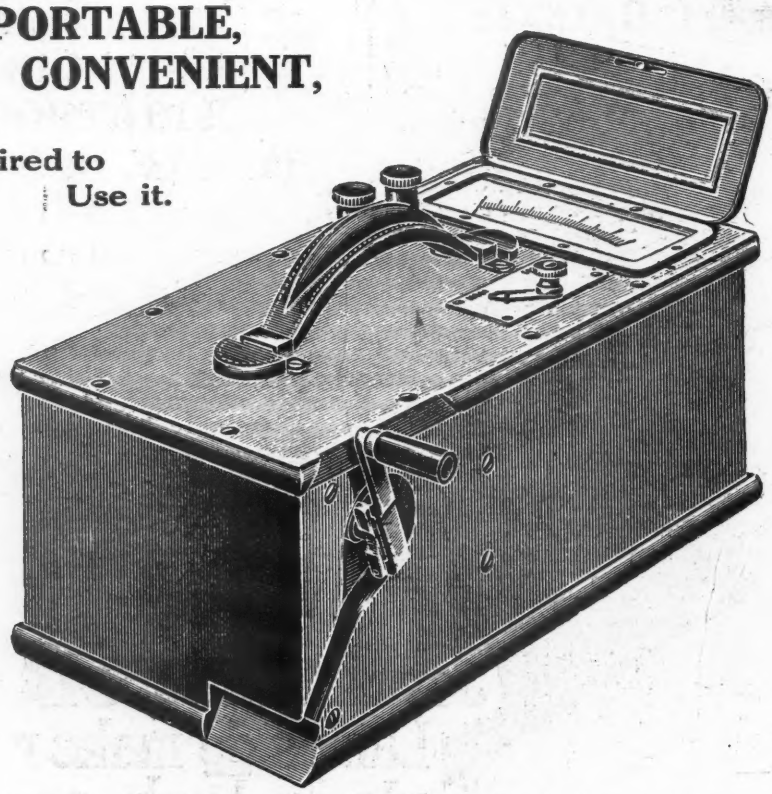

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The ELECTRICAL REVIEW is the recognised Medium of the Electrical Trades, and has BY FAR THE LARGEST CIRCULATION of any Electrical Industrial Paper in Great Britain.

NOTICES RELATING TO PATENTS.

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REMOVAL.
Mr. J. G. LORRAIN, M.I.E.E., M.I.Mech.E., Chartered Patent Agent, has removed his office from **Norfolk House, Norfolk Street, Strand, London, W.C.,** to Staple Inn Buildings, High Holborn, London, W.C.

THE OWNER of Patents Nos. 24,696/10, relating to "Improvements in Apparatus for the Production, Strengthening and Reception of Electric Vibrations," and 13,968/11, relating to "Improvements in Electric Capacitative-inductive Couplings," is desirous of negotiating with interested parties for the granting of licenses thereunder on reasonable terms.—For information apply to Messrs. LLOYD WISE AND CO., Chartered Patent Agents and Consulting Engineers, 10, New Court, Lincoln's Inn, London, W.C. 8658

OFFICIAL NOTICES.

Latest time for receiving 9.30 a.m. Thursday.

COMMONWEALTH OF AUSTRALIA.

Postmaster-General's Department,
December 22nd, 1913.

Tenders for Supply of Material.

TENDERS are invited for the supply of material as indicated below to the Postmaster-General's Department in Australia :—

Material required.	Where tenders receivable.	Date on which tenders close.
50 Cable Terminals, 26 pair, Schedule No. 308	Adelaide	11th Feb., 1914.
Cable Boxes as per Schedule No. 986	Melbourne	17th Feb., 1914.
Seven Automatic Switchboards, with associated equipment, according to Schedule No. 179	Sydney	18th Mar., 1914.

Tender Forms, Specifications, &c., may be obtained, and Sealed patterns inspected at the Commonwealth Offices, 72, Victoria Street, London, S.W.

AGAR WYNNE,
Postmaster-General. 8798

OFFICIAL NOTICES.—*Continued.*

COUNTY OF LONDON.

THE LONDON COUNTY COUNCIL invites Tenders for an electric lighting installation at the Popham Road Elementary School, South Islington, comprising about 130 lighting points.

Persons desiring to submit Tenders may, on and after Monday, 22nd December, 1913, obtain the Specification, Form of Tender, &c., on application to the Chief Engineer of the Council, Mr. G. W. HUMPHREYS, at the County Hall, Spring Gardens, S.W., upon payment to the Cashier of the Council of the sum of £1. This amount will be returnable only if the Tenderer shall have sent in a *bona fide* Tender and shall not have withdrawn the same. Full particulars of the work may be obtained on personal application, and the drawings, specification, and other contract documents may be inspected at the County Hall before the payment of the fee.

The Contractor will be bound to pay to all workmen employed by him in and about the execution of the contract, or any part thereof, wages at rates not less, and to observe hours of labour not greater, than the rates and hours set out in the Council's list, and such rates of wages and hours of labour will be inserted in and form part of the contract by way of schedule. Full particulars of the Council's Standing Orders on these matters are given in the *London County Council Gazette*. Tenders must be upon the official forms and the instructions therein must be strictly complied with. No Tender received after 11 a.m. on TUESDAY, 13th JANUARY, 1914, will be considered.

The Council does not bind itself to accept the lowest or any Tender, and it will not accept the Tender of any person or firm who has withdrawn a Tender after the same had been opened, unless the reasons for withdrawal were satisfactory to the Council.

LAURENCE GOMME,
Clerk of the London County Council.

County Hall, Spring Gardens, S.W.,
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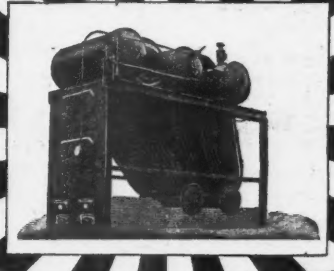
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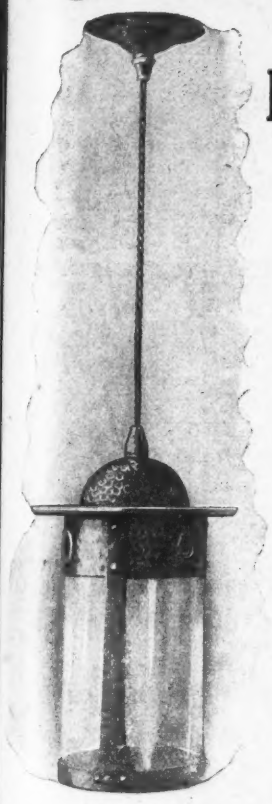

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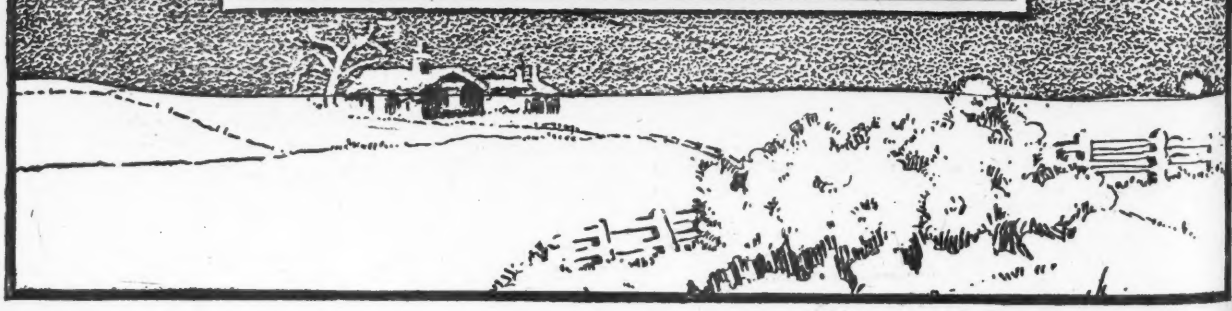

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Important Notice

JUDGMENT

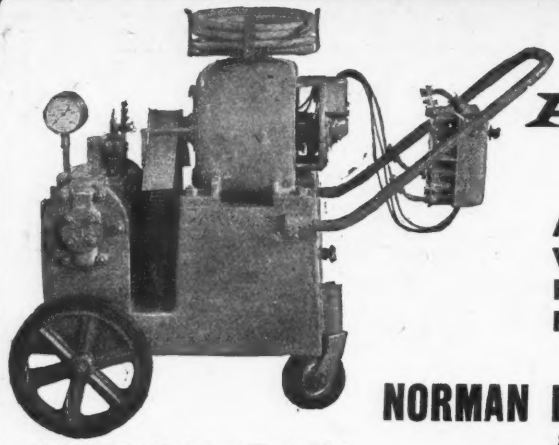
THE OSRAM LAMP WORKS, LTD., beg to inform the Trade and the Public, that on November 26th, 1913, in the High Court of Justice, Chancery Division, Mr. Justice Astbury **GRANTED AN INJUNCTION** against the **ORO LIGHT & GENERAL SUPPLY CO., LTD.,** 36, Cock Lane, Snow Hill, E.C. (in default of defence), in the action against them instituted by The Osram Lamp Works, Ltd., for infringement of **OSRAM** Patents 23,899* of 1904, and 18,622 of 1906 (the validity of which has been certified by the Court in a previous action) by the sale of

ORO LAMPS

stated by the Defendants to be manufactured by the Wolfram Lampen Aktiengesellschaft of Augsburg, Germany.

IT WAS FURTHER ORDERED that the Defendants deliver up to the Osram Lamp Works, Ltd, or destroy in the presence of their representatives, all such infringing lamps in their possession, and that an enquiry be held to ascertain what damages have been sustained by such infringement, and that the Defendants pay the Osram Lamp Works, Ltd., their full costs, charges and expenses in the action as between solicitor and client.

WARNING! Dealers in and users of similar infringing lamps will be proceeded against.



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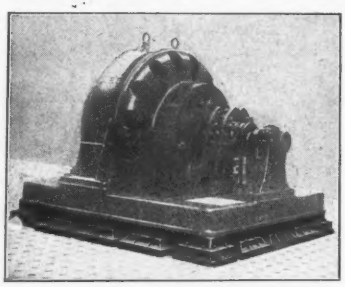

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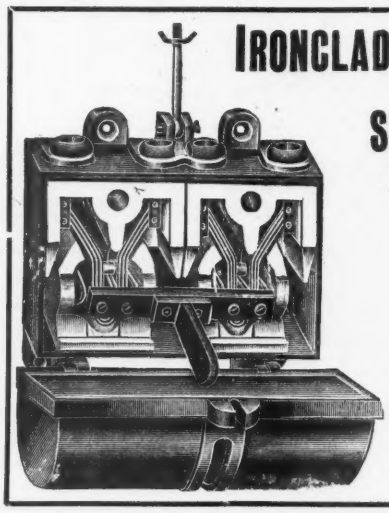

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HIGH-SPEED FORCED LUBRICATION GAS ENGINES

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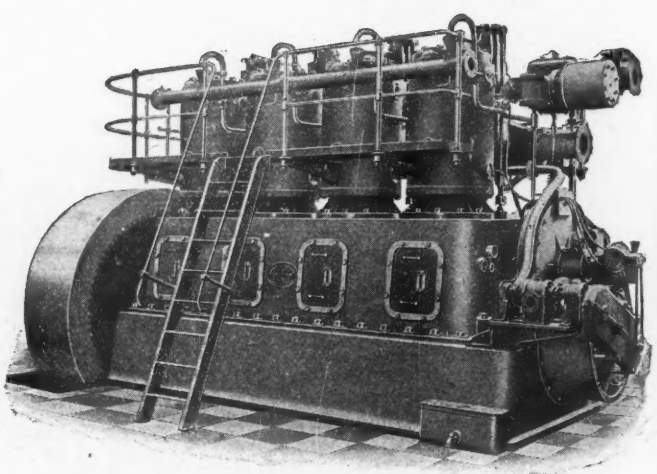
Manufactured with the same care and by the same SKILLED ARTISANS as the WORLD RENOWNED

BROWETT-LINDLEY STEAM ENGINES



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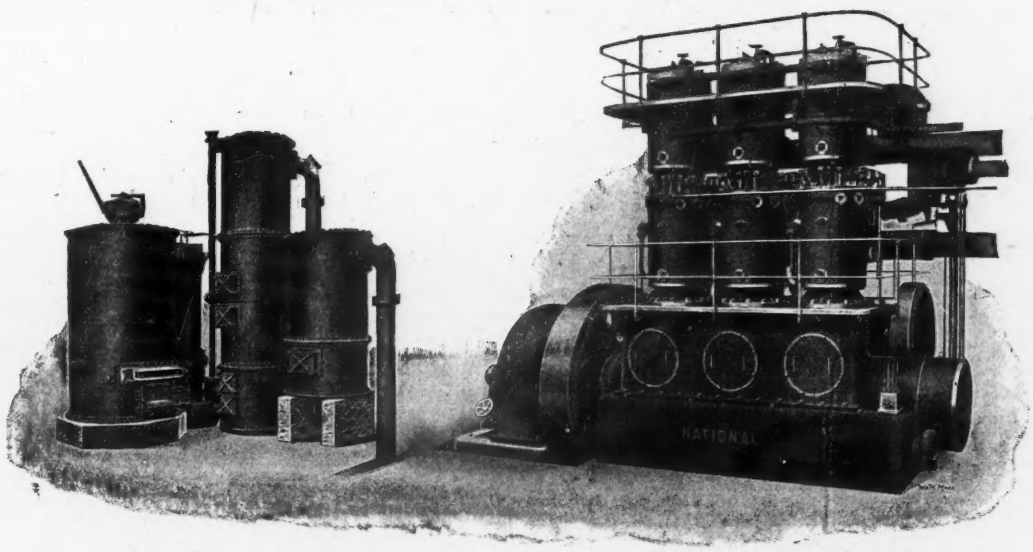

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These Engines are also built in sizes ranging from 300 H.P. to 1,500 H.P

Suitable for working with:

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Darlington, Southport, Tynemouth, Wigan, Harrogate, Bournemouth, Huddersfield, Batley (to mention a few), selected the **"PROCTOR" STOKER** and **MOVING FIRE BARS** to take the place of the **expensive** hand-firing method—they did so because money could be **saved** on the wages bill and **cheaper** coal could be used also—**another** saving—so the money expended on the **"PROCTOR" STOKER** installation is all **coming back, back again** in the **annual saving**—but the **"PROCTOR" STOKER** has such a long working life that after handing back its own cost—it makes a handsome **PROFIT** for the user! —while the cost of upkeep is not worth mentioning.

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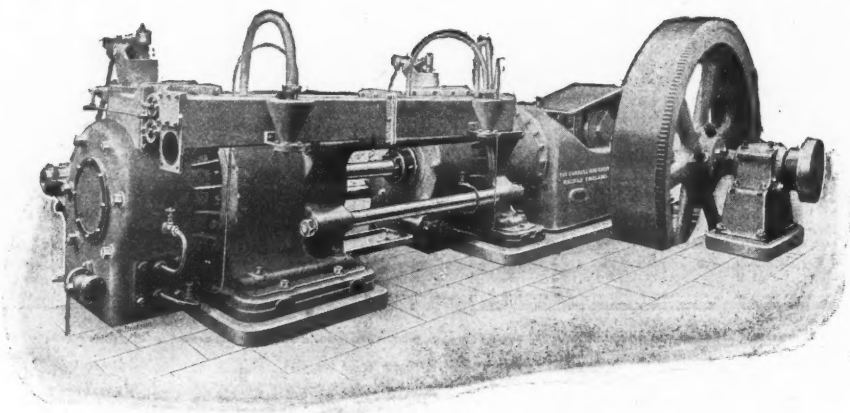

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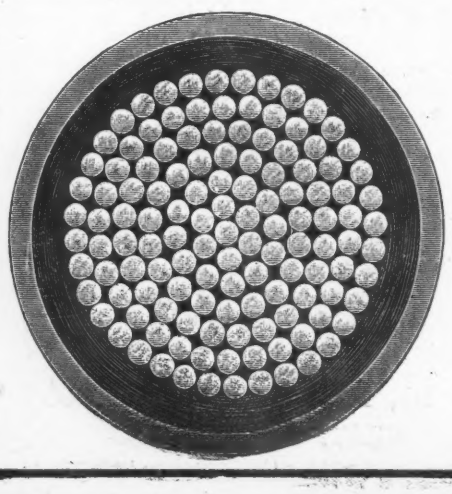

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INSULATED
CABLES
Copper, Bronze and Galvanised Iron Wires
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1913—1914

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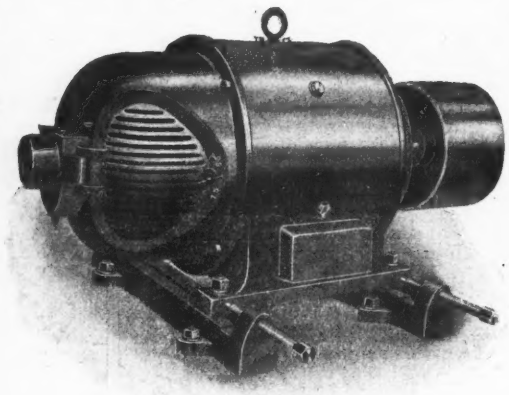

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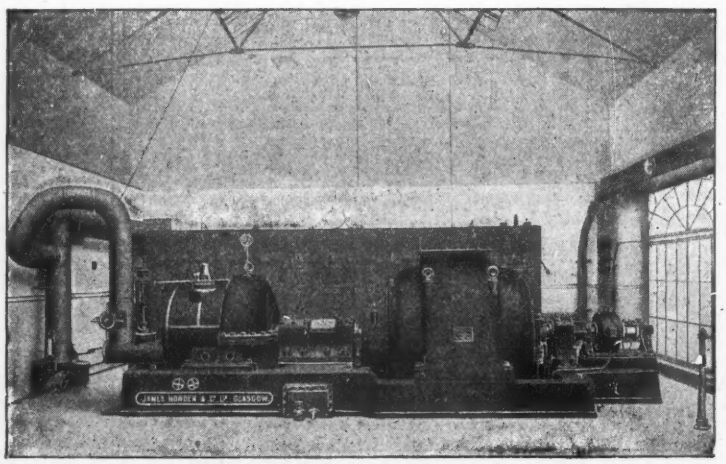

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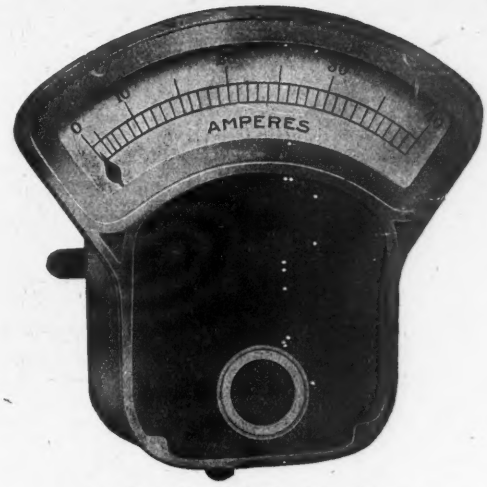

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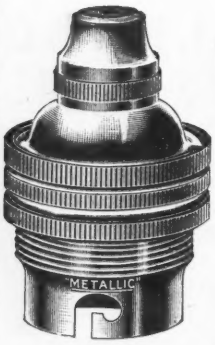
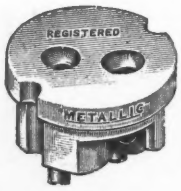
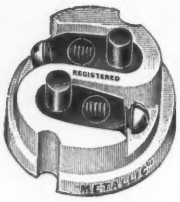


A 481.



Interior showing absence of Live Metal at Top of China.



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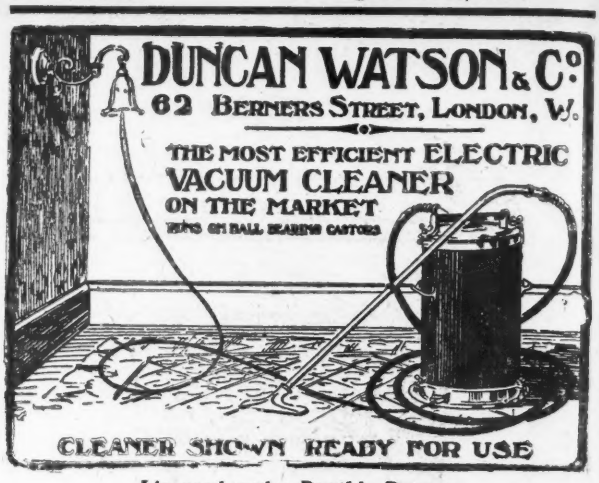

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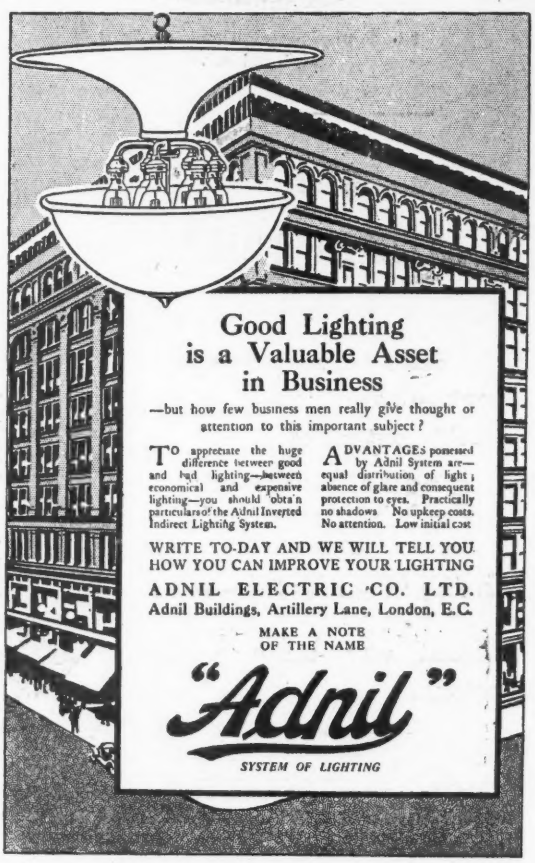

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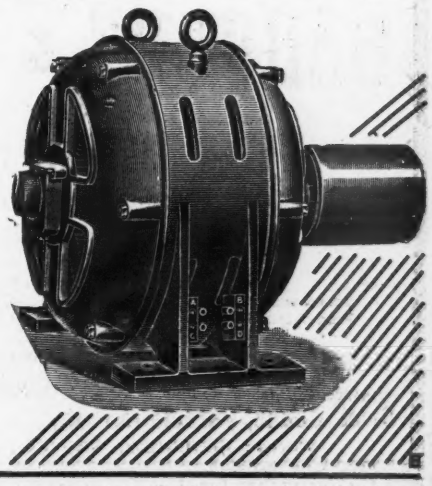

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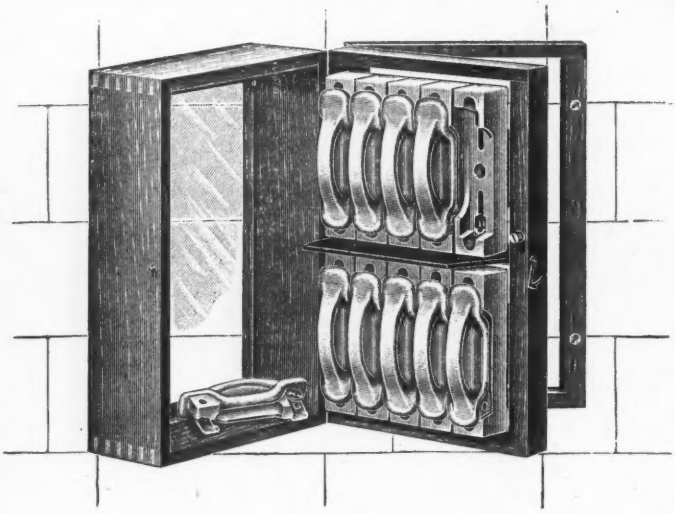

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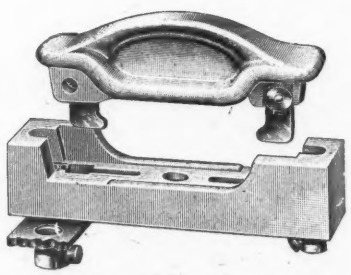

Enlarged View Showing Arrangement of Terminals.

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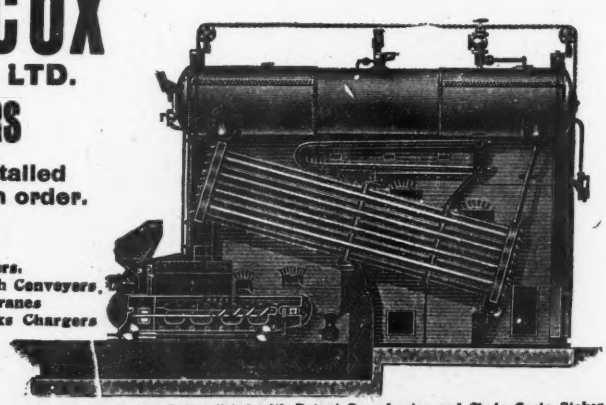

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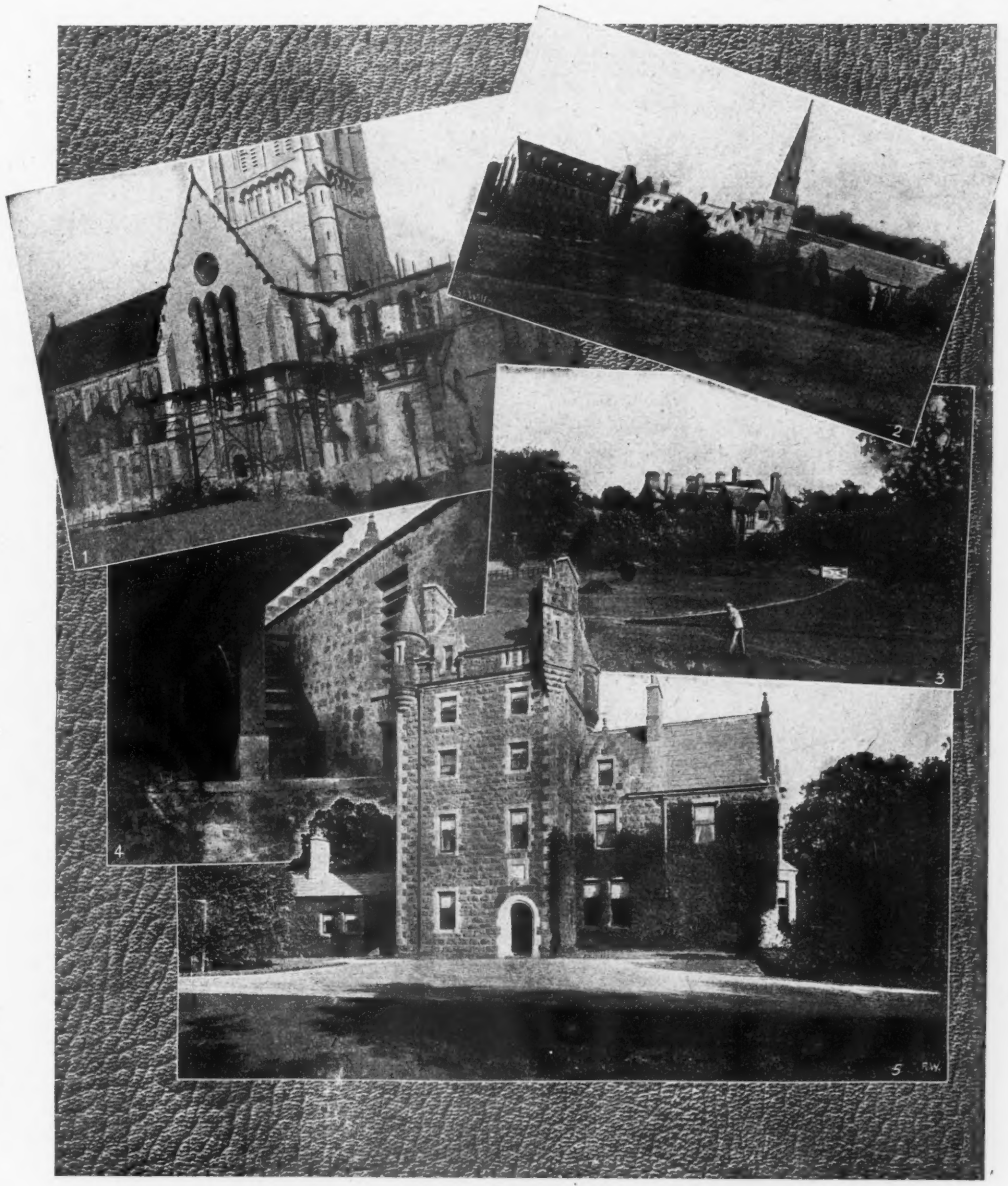

(1) Bermuda Cathedral. (2) St. Wilfred's College, Oakamoor.
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Very Happy Xmas

and a

Prosperous New Year.

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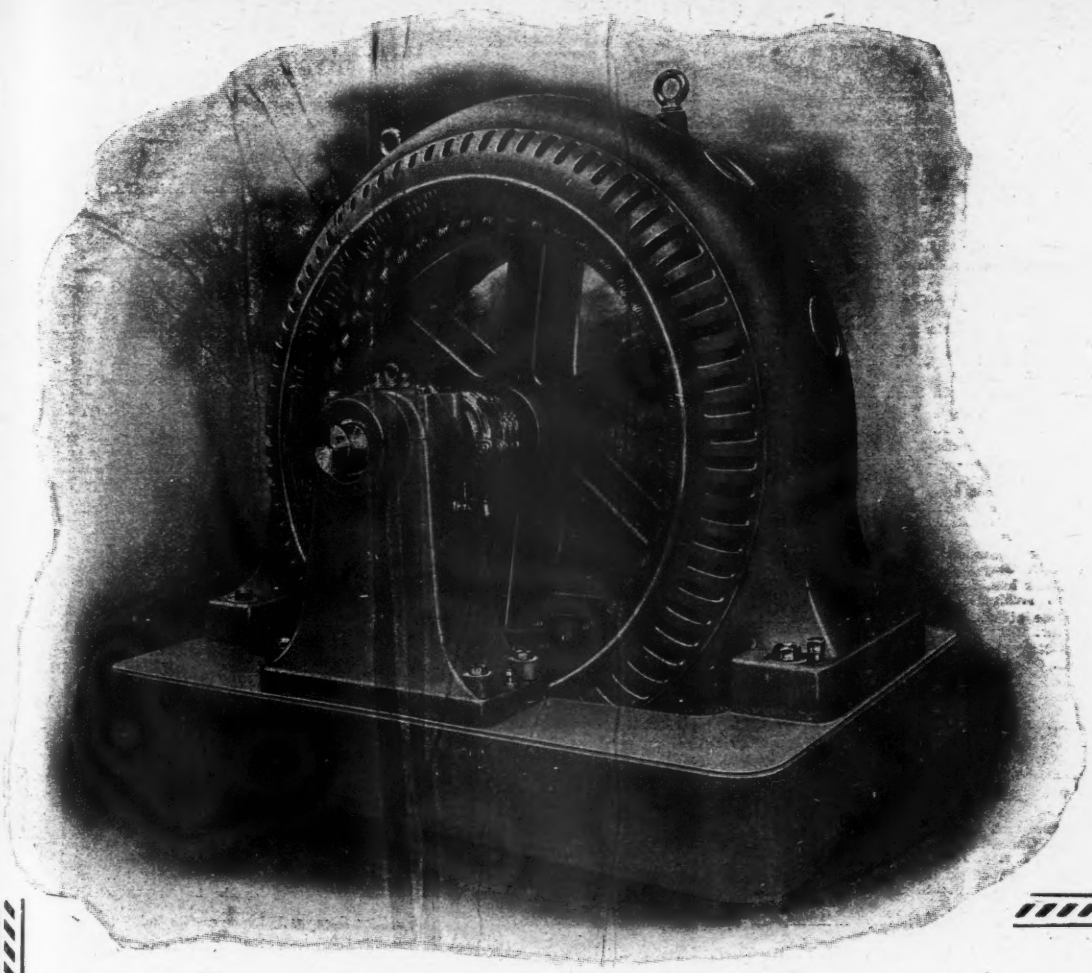

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CONTRACTORS' COLUMN.

[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERDEEN.—Shops in Hollybank Place, for J. Wallace, merchant; J. Cameron, architect. New Municipal buildings; The Surveyor.

ABERTYSSWG (CARDIFF).—50 houses, for The Tredegar Iron & Coal Co.; A. F. Webb, architect, Tredegar Chambers, Blackwood, Mon.

ALSAGER (STAFFS.).—Pumping station, waterworks, for the U.D.C.; F. W. Stocks, Engineer, Town Hall Chambers, Middlewich.

ARMITAGE (STAFFS.).—New Council schools at Armitage and Mavesyn Ridware, near Rugeley, for Education Committee; G. Balfour, Education Offices, Stafford.

ASHBY-DE-LA-ZOUCH.—Extensions to premises, for C. H. Parsons & Bro., Ltd.

ASHTON-UNDER-LYNE.—Secondary school, for Lancs. Education Committee; The Secretary.

ATHERSTONE.—New water works at Birchley Heath; H. J. Coleby, Surveyor to U.D.C.

BARNES.—Extensions to laundry, Glentham Road; W. Lowe, builder, Castelnau.

BLACKPOOL.—Alterations to the South Shore Hotel; Licensee.

BOLTON.—New Church of England school, etc., for All Saints', Moses Gate (£2,000); Rev. A. R. Swallow, Vicar.

BOURNEMOUTH.—Conveniences, Undercliffe Drive, for T.C.; F. W. Lacey, Borough Engineer. Enlargement of the Church of the Jesuit Fathers.

BRADFORD.—Reinstatement (after fire) Palmerston Buildings, Manor Road; W. A. Ross, architect, 9 & 10, Parkinson Chambers, Hustlergate. Enlargement of Manningham Road Primitive Methodist school; The Trustees.

BRENTWOOD.—Alterations and additions to Victoria Arms Hotel, Ongar Road, for Gray & Sons, Chelmsford; A. T. G. Woods, architect.

BURSLEM.—Billiard hall, for Willie Holt Co., Ltd., Burnley; Watkin and Adams architects.

BURY.—New place of worship for Limefield United Methodists; Rev. G. Kilgour.

CASTLEFORD.—New church, for St. John the Baptists, Lock Lane; Rev. A. L. Curry, Vicar of Allerton, Bywater.

CHATHAM.—Confectionery stores, Albany Road, for T. Schollar. Additions to music hall, High Street, for L. B. Barnard. Additions to Coachmakers' Arms, High Street, for Styler Winch, Ltd., brewers, Rochester.

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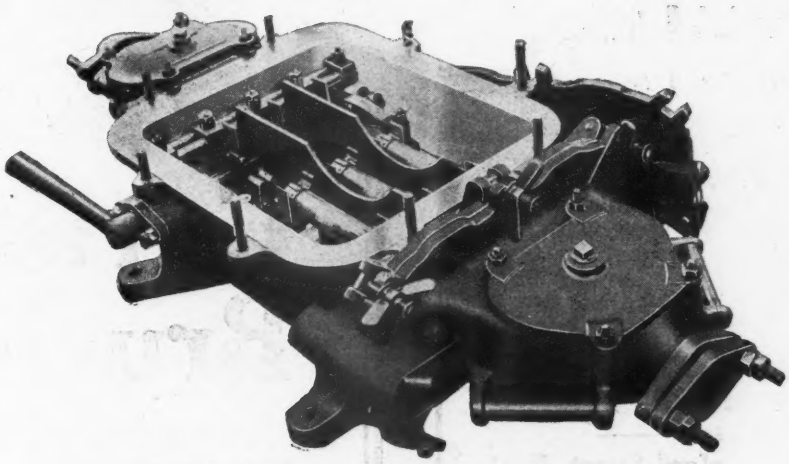

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Works : **PRESCOT AND HELSBY.**

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GLASGOW—260, St. Vincent Street.
BIRMINGHAM—9, Livery Street.
CARDIFF—1 and 2, Western Mail Chambers.
NEWCASTLE-ON-TYNE—33, High Bridge.
DUBLIN—17, Crow Street.
BELFAST—11, Queen Street.

Also at

Melbourne, Johannesburg, Capetown, Durban, Montreal, Mexico, Buenos Ayres, Bombay, Calcutta, Rangoon, Singapore, Hong-Kong, Shanghai, Yokohama, Constantinople, Cairo, Bilbao, Amsterdam, Christiania.

CONTRACTORS' COLUMN.

[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERDEEN.—Shops in Hollybank Place, for J. Wallace, merchant; J. Cameron, architect. New Municipal buildings; The Surveyor.

ABERTYSSWG (CARDIFF).—50 houses, for The Tredegar Iron & Coal Co.; A. F. Webb, architect, Tredegar Chambers, Blackwood, Mon.

ALSAGER (STAFFS.).—Pumping station, waterworks, for the U.D.C.; F. W. Stocks, Engineer, Town Hall Chambers, Middlewich.

ARMITAGE (STAFFS.).—New Council schools at Armitage and Mavesyn Ridware, near Rugeley, for Education Committee; G. Balfour, Education Offices, Stafford.

ASHBY-DE-LA-ZOUCH.—Extensions to premises, for C. H. Parsons & Bro., Ltd.

ASHTON-UNDER-LYNE.—Secondary school, for Lancs. Education Committee; The Secretary.

ATHERSTONE.—New water works at Birchley Heath; H. J. Coleby, Surveyor to U.D.C.

BARNES.—Extensions to laundry, Glentham Road; W. Lowe, builder, Castelnau.

BLACKPOOL.—Alterations to the South Shore Hotel; Licensee.

BOLTON.—New Church of England school, etc., for All Saints', Moses Gate (£2,000); Rev. A. R. Swallow, Vicar.

BOURNEMOUTH.—Conveniences, Undercliffe Drive, for T.C.; F. W. Lacey, Borough Engineer. Enlargement of the Church of the Jesuit Fathers.

BRADFORD.—Reinstatement (after fire) Palmerston Buildings, Manor Road; W. A. Ross, architect, 9 & 10, Parkinson Chambers, Hustlergate. Enlargement of Manningham Road Primitive Methodist school; The Trustees.

BRENTWOOD.—Alterations and additions to Victoria Arms Hotel, Ongar Road, for Gray & Sons, Chelmsford; A. T. G. Woods, architect.

BURSLEM.—Billiard hall, for Willie Holt Co., Ltd., Burnley; Watkin and Adams architects.

BURY.—New place of worship for Limefield United Methodists; Rev. G. Kilgour.

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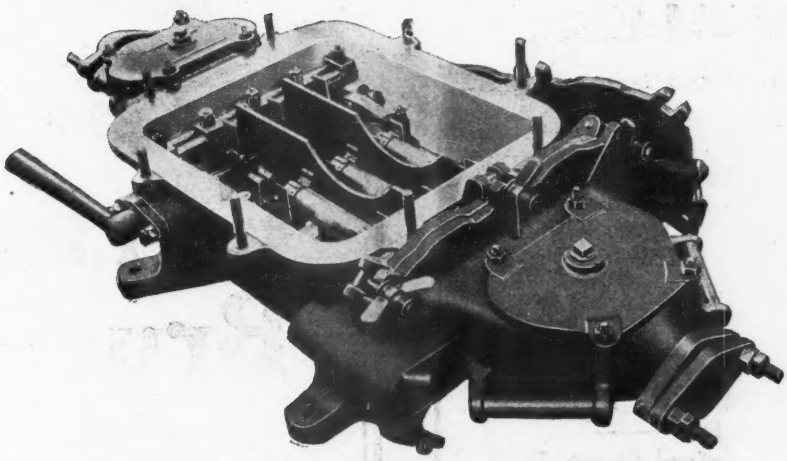

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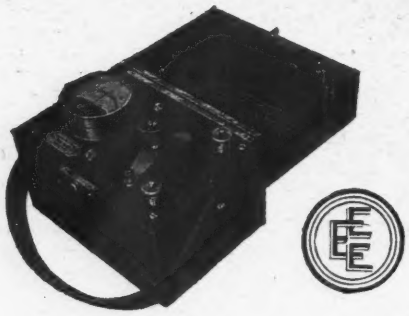

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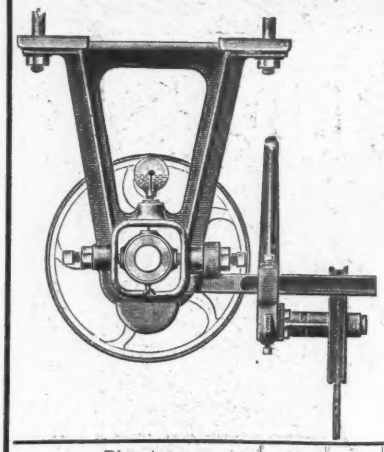

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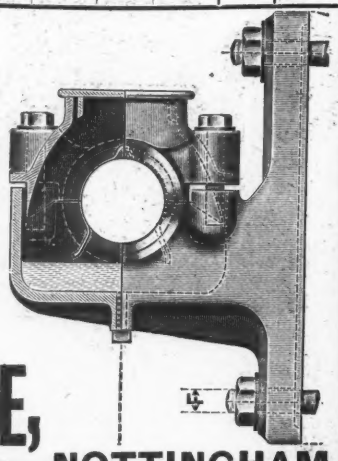

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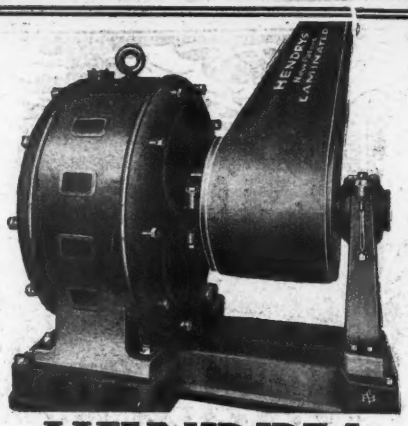

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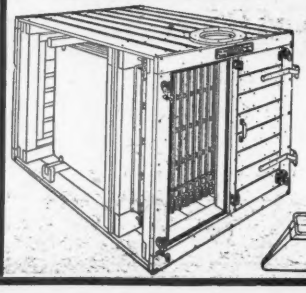

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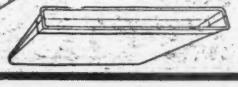

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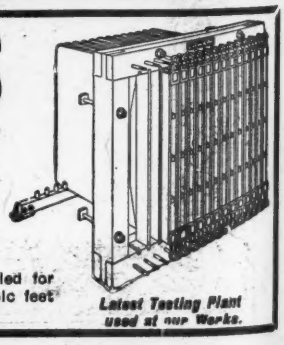

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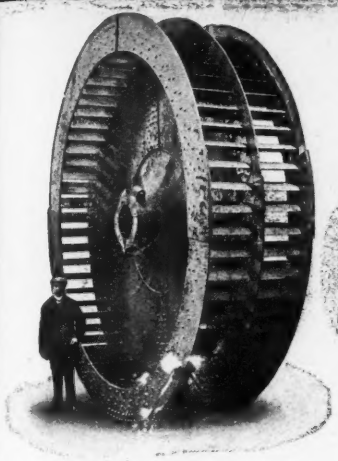

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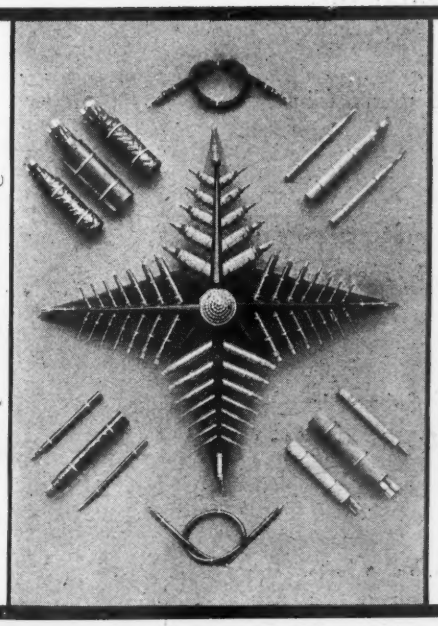

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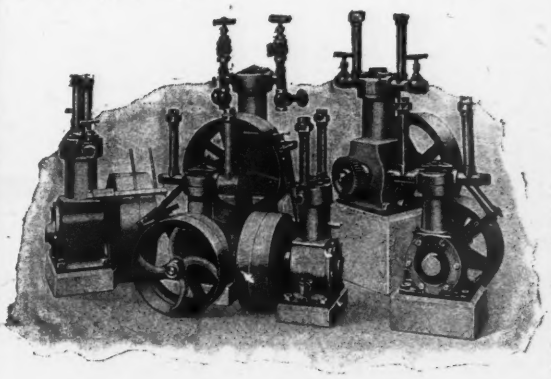

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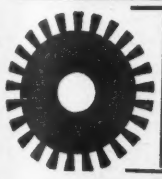
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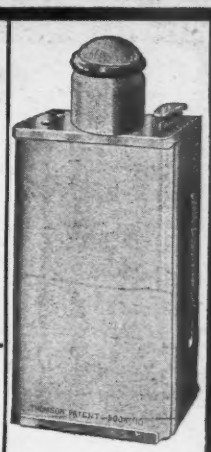
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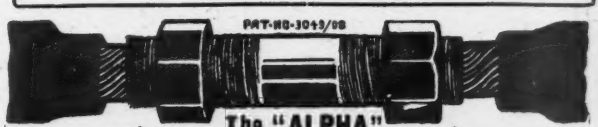

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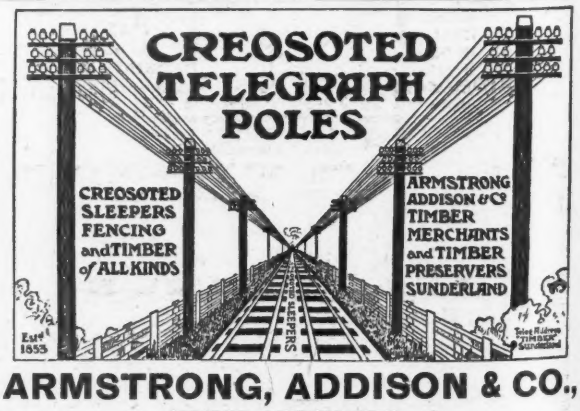
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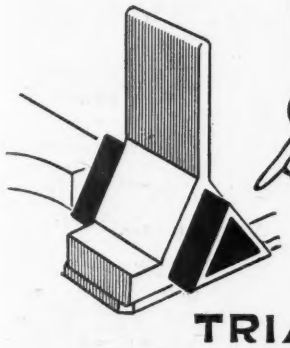

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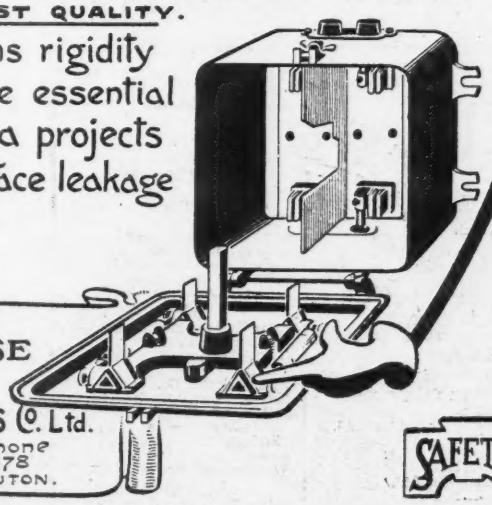

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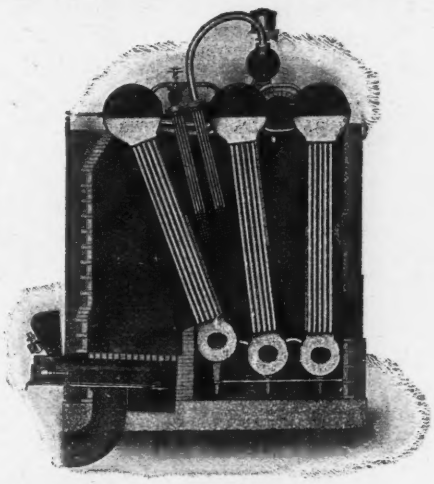

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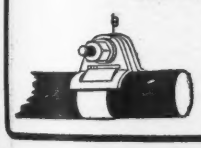

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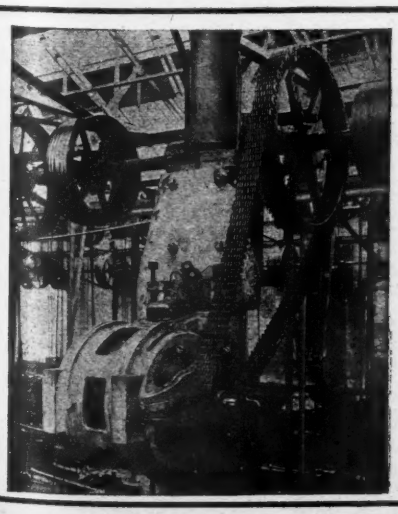

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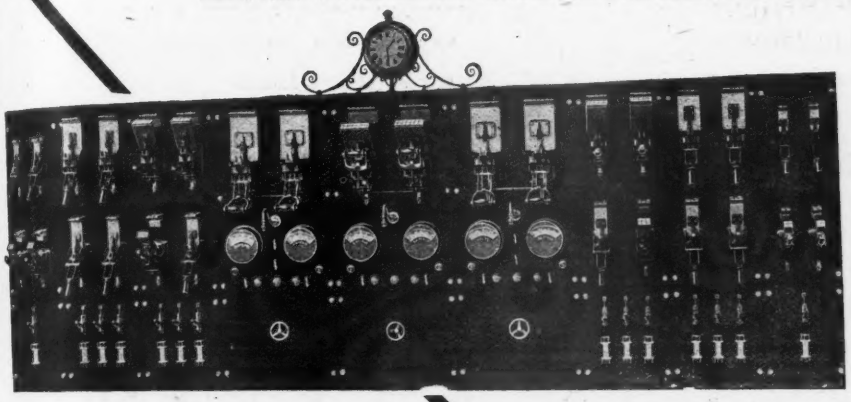

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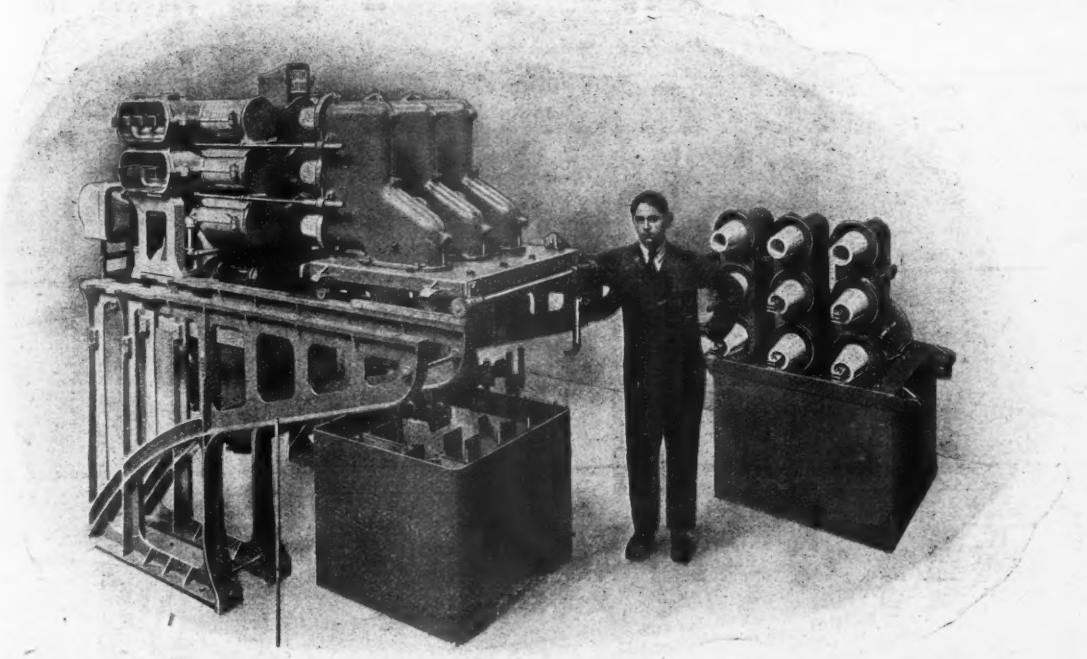

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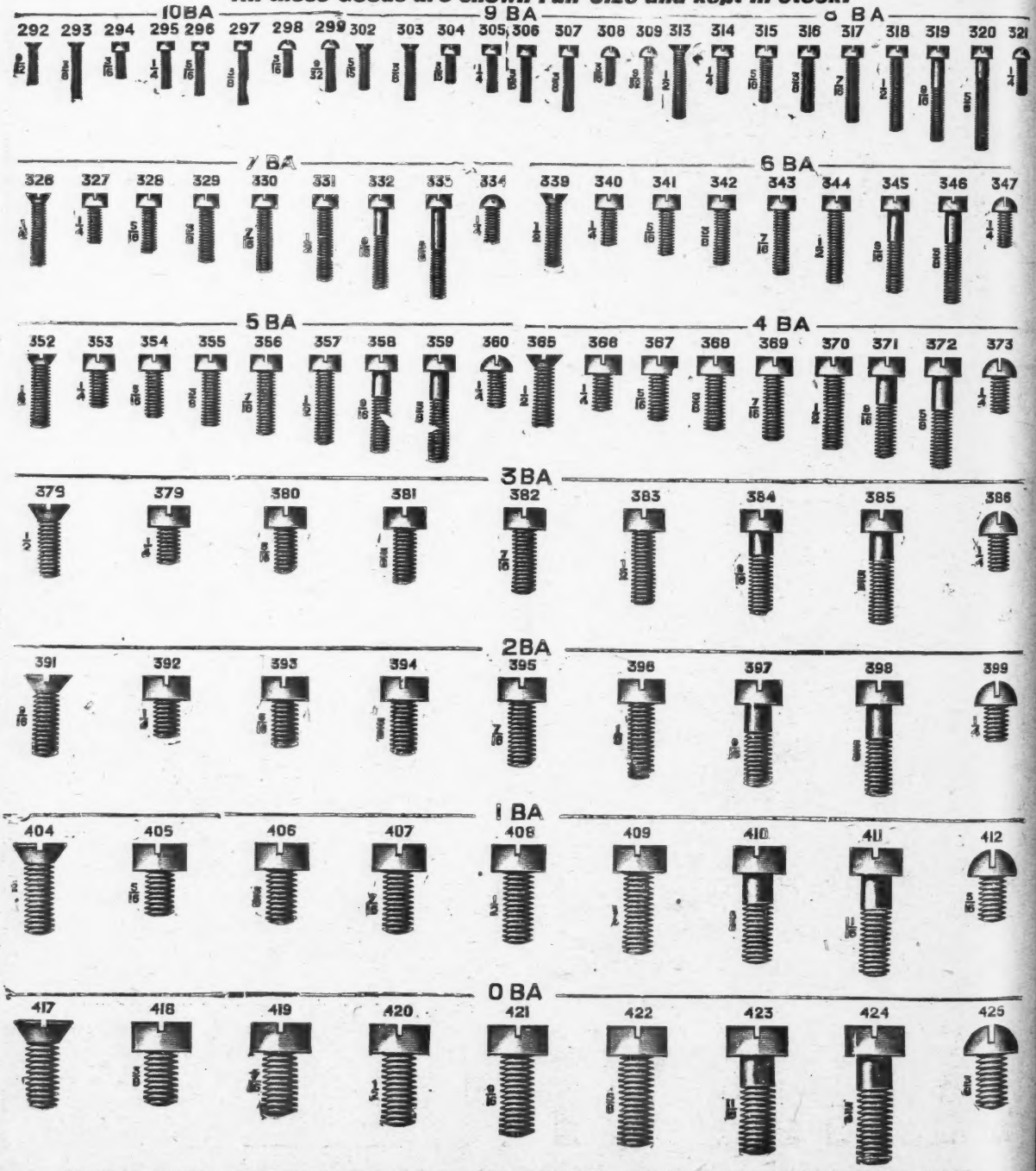

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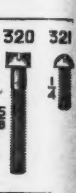

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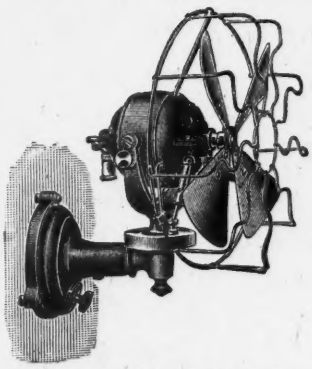

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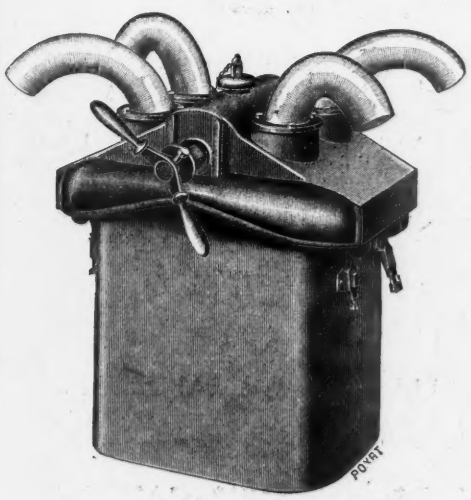

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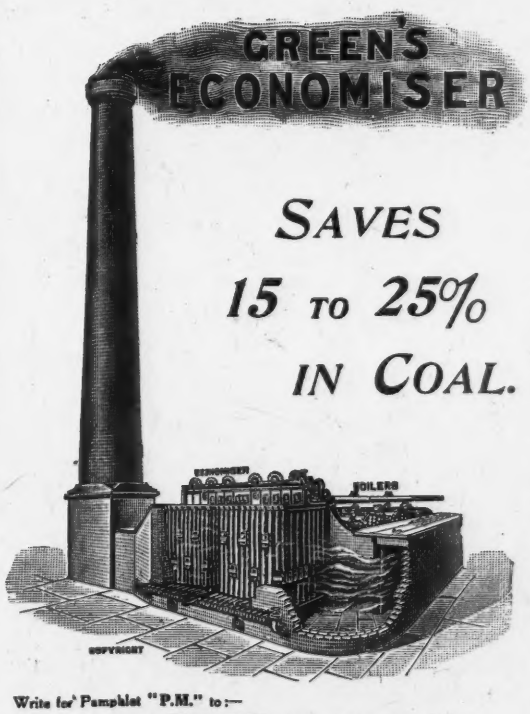

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